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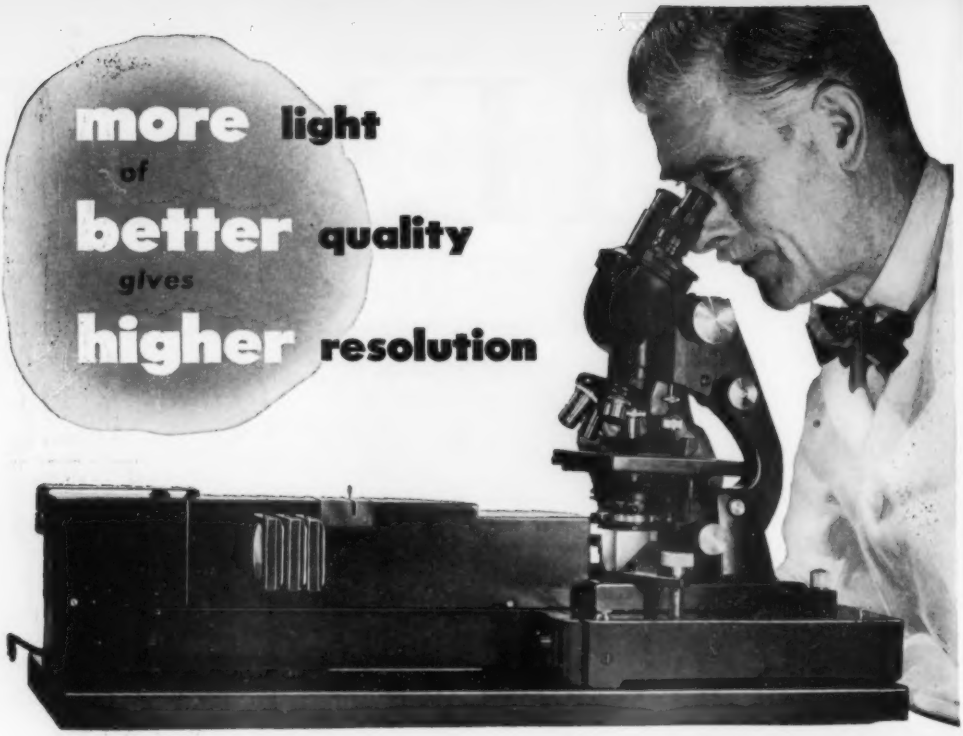

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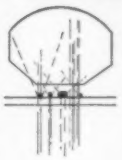

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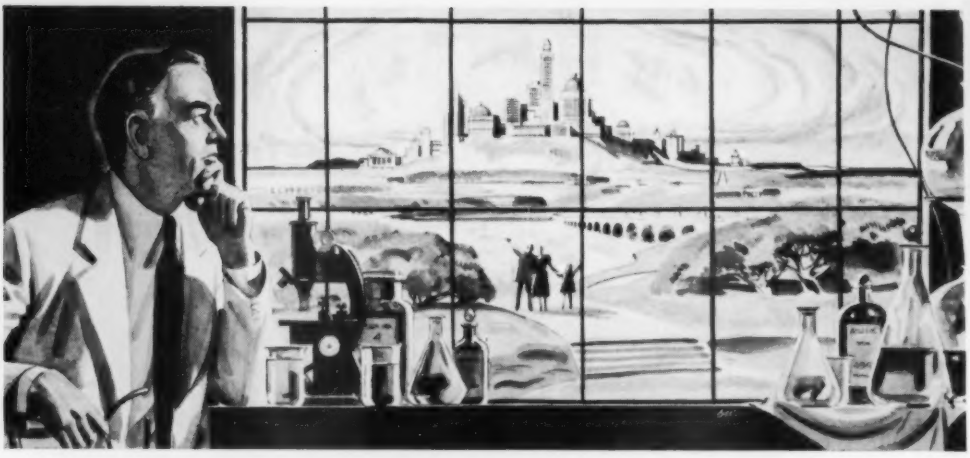

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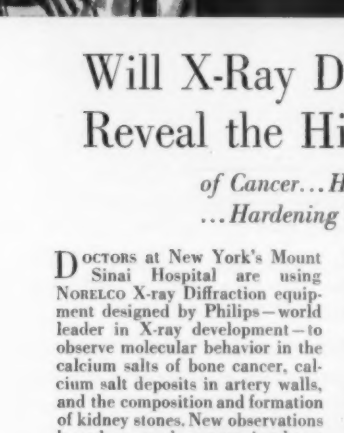

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Putting Science Together

THE annual meeting of the Association has the reputation of being the biggest scientific show on earth. In respect to size this is not so, but from several other standpoints the AAAS may as well modestly admit it. No other scientific event brings the accomplishments of scientific research so forcibly to public attention, thanks to thorough and brilliant coverage by the science writers of the country. No other meeting brings so many experts in diverse fields together to explore the fertile areas in which disciplines meet and overlap. In no other convention do so many organizations cooperate in the exploitation of collective experience. The phrase that captured popular fancy in the Association's Arden House statement of policy—"to put science back together again"—is merely a description of what has been going on in a quiet way for several years.

The annual meeting overshadows other AAAS-sponsored meetings, but the others may appropriately be mentioned in an issue of SCIENCE devoted to the St. Louis convention. It will be evident that the Association gets around, not only in this country, but abroad, for in 1952 it has been officially represented at meetings in every continent except Asia.

In May the Southwestern Division met with the Colorado-Wyoming Academy of Science at Boulder, Colorado, and 457 scientists in the Rocky Mountains, Great Plains, and Intermountain states assembled to discuss regional, but by no means provincial, contributions to the advancement of science (SCIENCE, **116**, 135 [1952]). In June the Pacific Division played host to 17 affiliated and associated organizations at Corvallis, Oregon (SCIENCE, **116**, 407 [1952]), and 1095 scientists, mostly from Western states and Canadian provinces, demonstrated a vigorous interest in, and prosecution of, scientific and technological research. From mid-June to early September, approximately 2000 specialists gathered in a succession of weekly Gordon Research Conferences at Colby Junior College, New London, New Hampshire, and at the New Hampton School, New Hampton, New Hampshire, to consider the new discoveries and new techniques in chemical and related fields. In September, the Association's sections on Engineering (M) and Geology (E) met with the Industrial Minerals Division, American Institute of Mining and Metallurgical Engineers, at the Centennial of Engineering in Chicago to consider the raw materials survey of the Chicago region, structural materials, and the recovery of ground water for industrial use. Also in September, at McKinley National Park, the Alaska Division sponsored the Third Alaskan Science Conference, bringing together more than 200 specialists who are systematizing and solving scientific problems indigenous to our northern territory.

The Association also has five active branches that carry on its work within restricted areas. The organization of the Alaska Division is unique in that it consists of three branches—Cook Inlet, Arctic, and Southeastern—each organized around a center or nucleus of scientific activity. Within the continental United States branches have not been regarded as an essential element in AAAS structure because of the work of state academies of science; yet the Lancaster (Pa.) Branch functions in a state with an active academy, bringing science and scientists to a community audience numbering 500–800. Only one other branch is currently active—Springfield (Mass.), which is operating in a section where state academies are scarce.

The Association has been officially represented at scores of other meetings and ceremonies. On some of these occasions the AAAS representative was an active participant—for example, Detlev W. Bronk gave the exchange lecture at the Belfast meeting of the BAAS in September. Enough has been said to indicate that the Association exerts a continent-wide influence in its meeting activities. From all indications this influence is destined to spread and to give American science and scientific thinking some integration and direction.

H. A. MEYERHOFF

Administrative Secretary, AAAS

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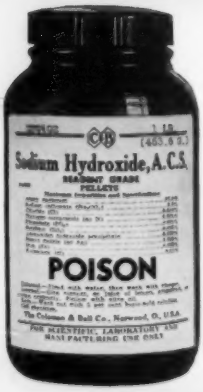

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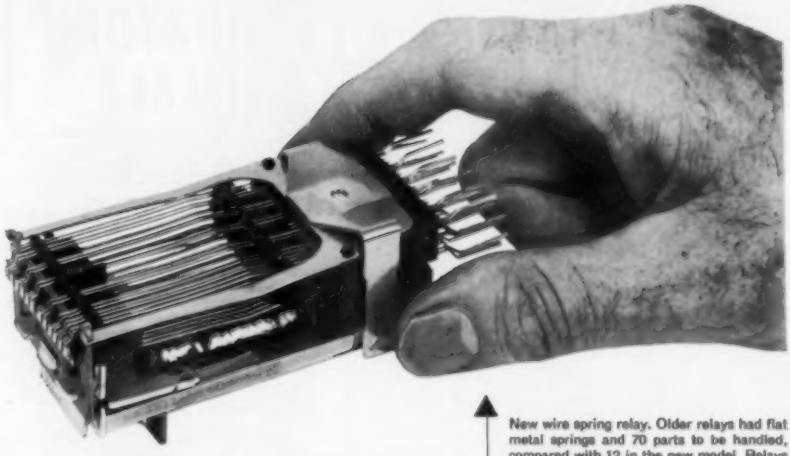

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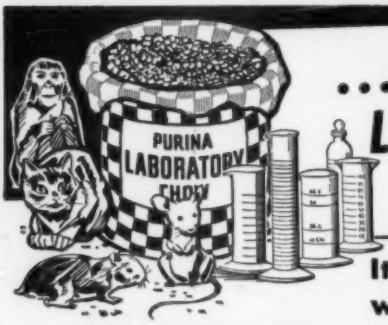

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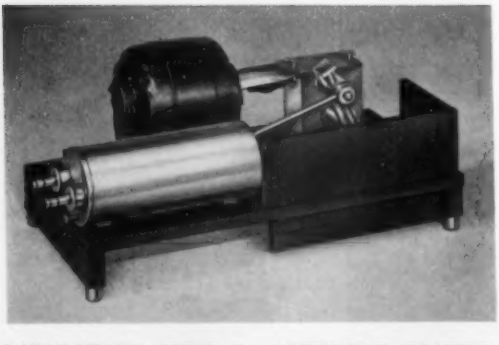

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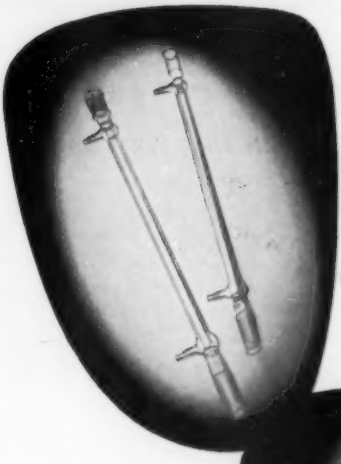

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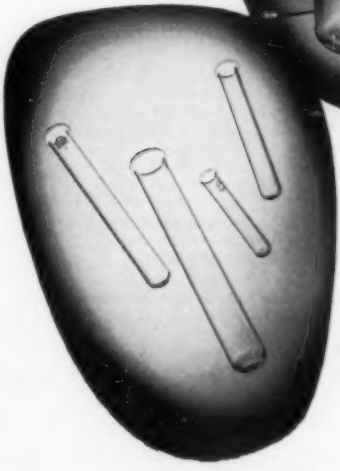

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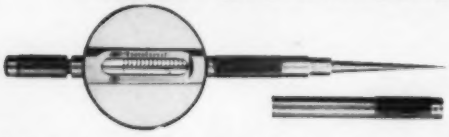

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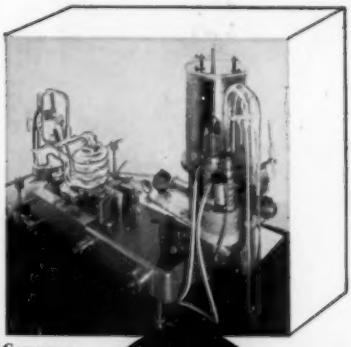

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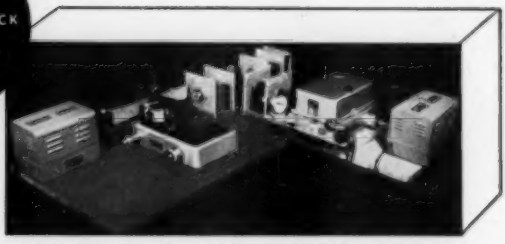

Fordham University—Two-monochromator set-up for testing reaction of human eye to light intensity developed at psychology laboratory.

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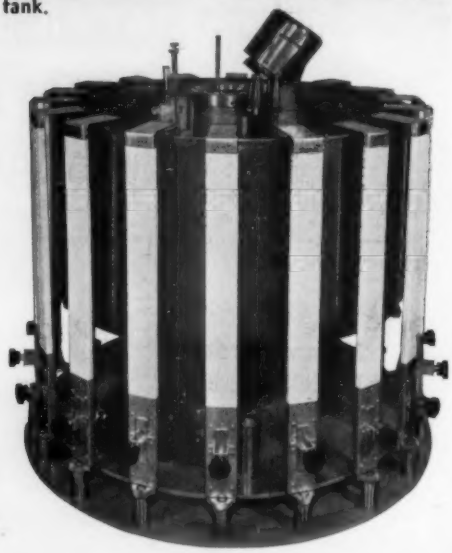

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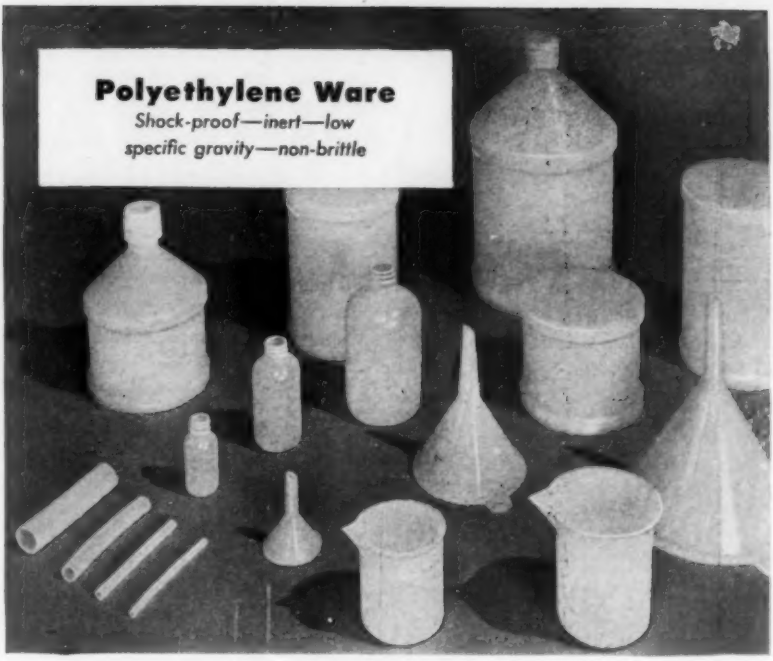

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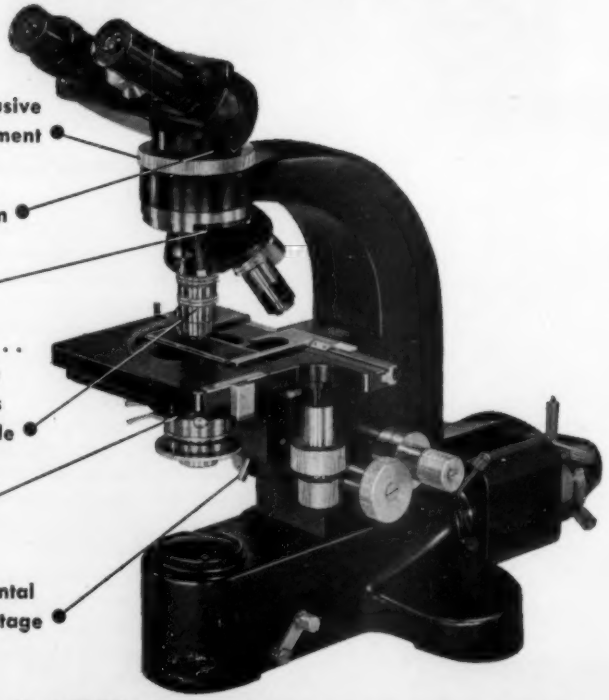

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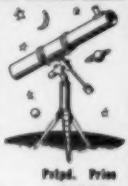

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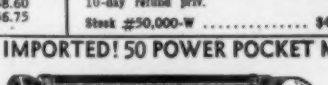

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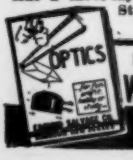

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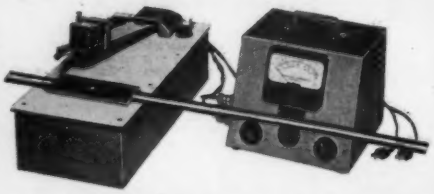

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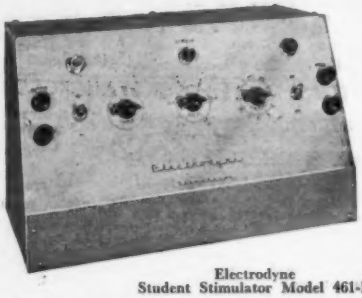

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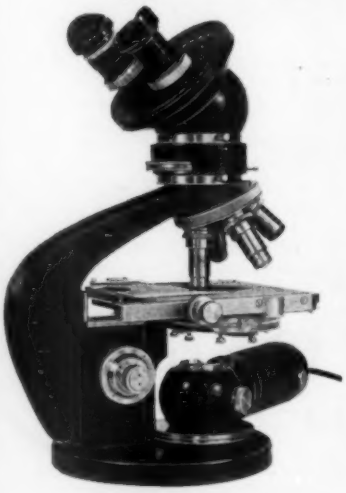

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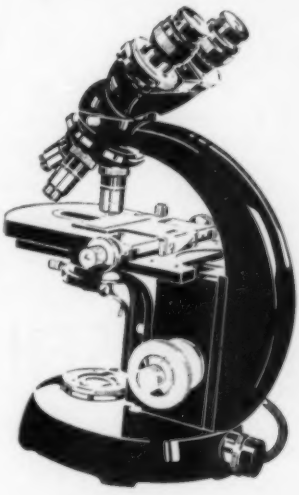

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Kiel Auditorium, St. Louis

DECEMBER 27-30

Preview of the 119th Meeting, AAAS, St. Louis December 26–31, 1952

THE 119th meeting of the American Association for the Advancement of Science—in the quality and variety of its programs, in the several conferences now on an annual basis, and in the business to be transacted—will be one of the most important annual meetings in the history of the Association, now well into its 105th year. In addition to the programs of the 18 sections and subsections, 56 societies and other organizations are participating in the meeting. These include three mathematical societies; the Oak Ridge Institute of Nuclear Studies; the Society of Systematic Zoology; three science teaching societies; the Society for Industrial Microbiology; and such medical groups as the American Academy of Forensic Sciences, the American Association of Hospital Consultants, the American Physiological Society, and the American Psychiatric Association.

Faculty members of Saint Louis University and of Washington University have generously assisted some of the Association's sections in arranging symposia or sessions of invited papers that will bring together specialists from all parts of the nation. Scientists of the research laboratories of Anheuser-Busch, Inc., and Monsanto Chemical Company have been responsible for other symposia. Local members and friends of the Association—scientists, industrial executives, physicians, and others—are cooperating to make the sixth St. Louis meeting at least as well attended and as successful as the previous five meetings in this metropolis of the Missouri-Mississippi basin. Washington University is host to the mathematicians for four intensive days. The nationally known Central Institute for the Deaf and the Missouri Botanical Garden will each be the scene of a day of sessions for Sections M and G, respectively. AAAS Section C and the Academy of Science of St. Louis will collaborate in a celebration of the centenary of Washington University, the dedication of Louderman Hall, and the vice-presidential address of Carroll A. Hochwalt.

Officially, this meeting of the Association is the concluding event of the Centennial of Engineering, and there is a substantial emphasis on engineering, physics, chemistry, and industrial science in the more than 300 sessions. No principal field of science, however, will be neglected. Indeed, the botanical sciences, with both symposia and sessions for contributed papers, are well represented; the zoological programs—with papers, four public discussion panels of books (in which eight authors will debate their subjects), and symposia—are wide in their appeal; and the medical sessions are more numerous and varied than at any AAAS meeting in recent years.

This year the AAAS is sponsoring three general symposia: "Disaster Recovery" (two sessions) is a serious attempt to assess the common principles and aspects of recovery from large-scale disasters, both natural and man-made. "Applications of the Theory of Games" will interest mathematicians and laymen alike. "The Nation's Nutrition: From Soil to Cytoplasm" (two sessions) brings together all pertinent aspects of the sources of food and the biochemistry of human nutrition. Speakers in these general symposia not only are national authorities but are able speakers as well. Sixty symposia and panels are being sponsored or cosponsored by AAAS sections (SCIENCE, 116, 550 [1952]; THE SCIENTIFIC MONTHLY, 75, 322 [1952])—in contrast with the 42 symposia featured at the Philadelphia meeting last year. In scheduling a record-breaking number of symposia, however, the sections have not failed to provide opportunities for those who wish to read papers. The following sections have multiple, and in some cases concurrent, sessions for contributed papers: C—Chemistry, D—Astronomy, E—Geology and Geography, F—Zoological Sciences, G—Botanical Sciences, H—Anthropology, I—Psychology, L—History and Philosophy of Science, Np—Pharmacy, and Q—Education.

The Conference on Scientific Manpower II and the annual Academy Conference have been joined this year by the Conference on Scientific Editorial Problems I. The special sessions—the annual addresses of the American Mathematical Society and the United Chapters of Phi Beta Kappa (both on Dec. 27), of the retiring AAAS president (Dec. 28), the National Geographic Society, and the Society of the Sigma Xi (both on Dec. 29), and the Scientific Research Society of America (Dec. 30)—are described later. At the meetings of the Association Council, revision of the constitution and bylaws and the problem of a new headquarters building are two important matters that will be considered.

The Annual Exposition of Science and Industry will again be a large-scale series of exhibits of the latest tools and techniques in science and industry. As will be noted from the appended directory of exhibitors and the descriptions of their exhibits, there will be an especially prepared exhibit by the Association of American Railroads; the American Cancer Society's exhibit on cancer of the cervix is new; and there are interesting and important scientific exhibits in medicine and in instrumentation. Adjacent to the exposition, the AAAS Science Theatre once more will show the latest foreign and domestic scientific films. All principal fields of science are represented in the programs, and many of the titles are late 1952.

Hotel Headquarters

An article on "Hotel Headquarters" appeared in the July 25 issue of SCIENCE (116, 97 [1952]), in which the headquarters hotels for sections, subsections, and participating societies were listed. Any additions or last-minute changes will be found in the General Program.

Registration

Main Registration-Information Center. The Main Registration-Information Center is located in the Kiel Auditorium, at the top of the ramp which begins at the 14th St. Entrance. It will be open daily, Friday, Dec. 26, through Wednesday, Dec. 31, 8 A.M. to 6 P.M., except on Monday evening, Dec. 29, when it will remain open till 11 P.M. to accommodate those nonregistrants who wish to attend the Biologists' Smoker.

Badges and General Programs may also be obtained

at the supplementary registration desks, but the *Main Registration* is the only place to receive supplementary literature, maps, and the like. *Advance Registrants* (who have received programs and badges prior to the meeting) are urged to visit the Main Registration, at any convenient time, to receive these items.

Supplementary Registration Desks. There are four supplementary registration desks, as follows:

Hotel Jefferson

Dec. 26	Noon–9 P.M.
Dec. 27	8 A.M.–8 P.M.
Dec. 28	8 A.M.–8 P.M.
Dec. 29	8 A.M.–8 P.M.

Hotel Statler

Dec. 26	4 P.M.–9 P.M.
Dec. 27	8 A.M.–8 P.M.
Dec. 28	8 A.M.–8 P.M.
Dec. 29	8 A.M.–1 P.M.

Hotel De Soto

Dec. 26	1 P.M.–9 P.M.
Dec. 27	8 A.M.–8 P.M.

Washington University, Women's Building

Dec. 26	Noon–9 P.M.
Dec. 27	8 A.M.–8 P.M.
Dec. 28	Noon–6 P.M.

Registration Fee. Each person who registers has the satisfaction of knowing that he has paid his personal share of the expenses of the meeting, and that he has become a definite participant in the meeting. As a registrant, he may visit the AAAS Science Theatre repeatedly and enjoy refreshments and tobacco at the Biologists' Smoker. The AAAS registration fee for all persons is $2.50. Each registrant receives a receipt, a Convention Badge, and the General Program–Directory—the only publication with the programs of all 18 AAAS Sections and the 40–50 participating organizations. Those who wish an extra copy of the General Program–Directory, valuable for its general reference material on the AAAS, may secure one for $1.50. Any person who purchased an advance copy of the General Program–Directory but did not register in advance and who then attends the meeting, may complete his registration by the payment of $1.00—for which he receives his Convention Badge and the privileges that go with it.

AAAS Convention Badge. The AAAS Convention Badge should be worn throughout the meeting because (1) it reminds others to register; (2) it is needed for admission to the AAAS Science Theatre, the Biologists' Smoker, and the Reception that follows the Presidential Address; and, not least, (3) it helps your friends to find you.

Visible Directory of Registrants. The Visible Directory of Registrants is located in the Kiel Auditorium and is reached by passing through the exhibit area of the Annual Exposition of Science and Industry (around it when the Exposition is closed). The hours it will be open correspond exactly with the hours the Main Registration is open—daily, 8 A.M.–6 P.M., and Monday evening till 11 P.M. The registration cards of all registrants are placed in the Visible Directory as soon as possible after registration. The arrangement is alphabetical. The cards of advance registrants are *completely* alphabetized and typed, since they were posted in Washington prior to the meeting; all other registration cards are filed to the second or third letter of the surname (Ba, Be, etc.). Members of the Press, exhibitor personnel, and guests are included in the Visible Directory on *blue* cards.

Mail, Telegrams, and Messages. Mail and telegrams addressed in care of the AAAS will be held at the AAAS Office in the Kiel Auditorium. Every effort will be made to notify addressees listed in the Visible Directory, but the Association assumes no responsibility for the delivery of mail, telegrams, or messages.

Telephone and personal messages will be filed alphabetically in the AAAS Office, and the names for whom they are intended posted on a bulletin board.

Society Meal Function Tickets. In general, tickets to the dinners, luncheons, or breakfasts of any participating society are obtainable only from representatives of that society and during the preceding sessions of the society. Any society, however, has the privilege of the use of a AAAS supplementary registration desk in its headquarters hotel to serve as a ticket booth, provided that that portion is manned by a representative of the society. Experience has shown that it is much more satisfactory to all concerned for each organized meal function to be the responsibility of the society that sponsors it. *For a list of all meal functions, see "Dinners," etc.*, in the General Program.

Kiel Municipal Auditorium. The city-owned Henry W. Kiel Municipal Auditorium is a large, well-designed convention hall, generally rated as one of the best in the U. S. It faces north on Market St., with side entrances on 14th and 15th Sts., and thus is only a few blocks from all the downtown hotels. Except for the use of the Opera House portion on Monday evening, Dec. 29, for the National Geographic Society, *only one entrance will be used—the 14th St. Entrance.* From this entrance lobby, a ramp leads to the Convention Hall, or second floor level. Here in close proximity are located the Main Registration—Information, the AAAS Office, the Annual Exposition of Science and Industry, the Visible Directory of Registrants, the AAAS Science Theatre—and Meeting Room 2, Assembly Hall 1, and Assembly Hall 2. To reach the remaining session rooms, use the stairs from the corridors of Convention Hall.

LOCATION OF ROOMS AND FEATURES IN KIEL AUDITORIUM
(*Use 14th St. Entrance for all rooms except Opera House*)

AAAS Office	Room A, Second Floor, 14th St. side
Biologists' Smoker	Main Exhibition Hall (under Convention Hall), Street Level
Exposition	Convention Hall, Second Floor
Light Refreshments	Corridor, Second Floor, 14th St. and 15th St. sides
Main Registration–Information Center	Second Floor, 14th St. side
Opera House	Street Level, Market St.
New Member Service	Booth in Exposition
Science Theatre	Room C, Second Floor, 15th St. side

Session Rooms

Assembly Room 1	Second Floor,	14th St.	
Assembly Room 2	"	"	15th "
Assembly Room 3	Third	"	14th "
Assembly Room 4	"	"	15th "
Room B	Second	"	14th "
Room 3A	Third	"	" "
Room 3B	"	"	" "
Room 3C	"	"	15th "
Room 3D	"	"	" "
Room 4A	Fourth	"	14th "
Room 4B	"	"	" "
Room 4C	"	"	15th "
Room 4D	"	"	" "
Visible Directory of Registrants	Second	"	" "

Local Travel Directions

Since all the downtown hotels and the Kiel Auditorium are within a few blocks of each other—5 to 10 minutes of leisurely walking—no local transportation is required. In the event of inclement weather, taxis are available; fares (35¢–45¢) are the same for one to four passengers if they travel together. CHEROKEE bus running east on Washington Ave. turns south on 14th St. directly to the Auditorium. Bus fare is 17¢.

The distance to the Kiel Auditorium from Grand Ave. (Melbourne and Sheraton hotels) is about two miles; the distance from Kingshighway (Chase and Roosevelt hotels), about four miles. Use buses marked LINDELL on Lindell Blvd. or Locust St. for all but the Hotel Roosevelt; for the Roosevelt, use buses marked DELMAR or WASHINGTON. The Delmar bus line is six blocks from the Auditorium; the Lindell line, four blocks. Delegates should get off at 14th St. and walk south, or they can secure a transfer from either bus to the CHEROKEE line, which will take them directly in front of the Auditorium. Taxi fares are $1.00–$1.50 for one to four passengers (if together).

The distance from the downtown hotels to Washington University is about six miles; from the Melbourne and Sheraton about four miles; from the Chase and Roosevelt about two miles. *Going*, use buses marked LINDELL on Lindell Blvd. for all hotels except the Roosevelt, for which use bus marked DELMAR, transferring to CITY LIMITS bus. *Returning*, use buses marked LINDELL, except for the Roosevelt, for which use CITY LIMITS bus (north on Skinker Blvd., transferring at Delmar Blvd.). Bus fare is 17¢ each way. Taxi fares range from 75¢ to $1.75, depending on distance, for one to four passengers (if together).

Street-car transportation westward from the downtown area to Washington University is most direct via Routes 11 and 14, which run west on Olive St. to near Kingshighway (on which they jog south from McPherson St.), then west on Waterman St., and, finally, west on Pershing Ave. Get off at Skinker Blvd. The eastward route is the reverse. Fare is 17¢ each way. (For street-car transportation from Hotel Roosevelt, use Route 10 on Delmar, transferring to CITY LIMITS bus at Skinker Blvd.

AAAS Public Information Service

Each person who will deliver an address or present a paper at the St. Louis Meeting is requested to provide the Association's Public Information Service with 100 copies of a nontechnical abstract of his paper. One hundred copies of *complete* manuscripts are also required of papers presented by (1) officers of the Association; (2) officers and invited speakers who appear on the programs of the participating societies; and (3) authors whose papers are particularly newsworthy. Most authors already have recognized the necessity of this procedure and have sent their material to the Association's Director of Public Information, Sidney S. Negus, Medical College of Virginia, Richmond. If you are an author of an address or paper and have not done this, please send to Dr. Negus, *to arrive in Richmond on or before Dec. 15*, 100 copies of your nontechnical abstract and 100 copies of your full paper (or significant portions of it if it is unusually long). If it is impossible for you to send this material to Richmond to arrive by Dec. 15 (and mails are much slower in the pre-Christmas period), then mail all your material to Dr. Negus at the Hotel Jefferson, St. Louis—or deliver it to him in person in the AAAS Press Room, Mezzanine, Hotel Jefferson, before or during the convention. Please be sure, as an aid to the Association's Public Information Service, to send copies of your paper to your *local* newspapers with the time when it is to be presented in St. Louis indicated.

The necessity of keeping the general public informed of the results of the scientific research which it supports, directly and indirectly, is evident. Organized science and the individual scientist must have the understanding and support of all. It is, of course, equally important that the advances of science be publicized with accuracy and clarity and without sensationalism. Progress in this direction in recent years has been most gratifying, thanks in large part to members of the National Association of Science Writers, other accredited science reporters, managing editors of American newspapers, and program managers of radio and television stations.

It is in the interest of accuracy and completeness that science writers frequently wish to discuss various research results with investigators. It you are asked to cooperate in this respect or to participate in a press conference, please do so not only for your own protection but for the benefit of science in general. Scores of science writers will be covering the meeting. News stories filed by the representatives of all the wire services will be published and broadcast throughout the entire civilized world. At no other scientific meeting are the facilities for the dissemination of the most recent findings in all branches of science so complete as they are at the meetings of the AAAS.

This year, not only is the Association fortunate in the continued services of Dr. Negus, but also in its Local Subcommittee on Public Information, headed by Howard A. Marple, director of advertising and public relations, Monsanto Chemical Company.

AAAS Business Sessions

The *Executive Committee* of the Association will meet in the administrative secretary's suite at the Hotel Jefferson at 8:00 P.M. on Friday, Dec. 26. Dates and hours of subsequent sessions of the Executive Committee during the meeting will be decided at this first session.

The *Council* of the Association will meet Saturday afternoon, Dec. 27, at 4:00 P.M. in Private Dining Room 1, Hotel Jefferson. A second session of the Council is scheduled for Tuesday morning, Dec. 30, at 9:00 A.M. in the same room. All members of the Council have been notified individually, and it is hoped that all can attend.

Subjects to be considered by the Council (in addition to the prepared agenda) usually are first brought before the Executive Committee through the administrative secretary. During the meeting, communications for the Executive Committee should be submitted in writing and left at the Hotel Jefferson mail desk, addressed to Dr. Howard A. Meyerhoff.

There will be a meeting of all section chairmen and section secretaries, Tuesday noon, Dec. 30, in Private Dining Room 4, Hotel Jefferson. Howard A. Meyerhoff and Raymond L. Taylor, *Co-Chairmen*.

AAAS Special Sessions

One of the characteristic and most important features of the annual meetings of the Association is the series of outstanding general lectures and addresses by distinguished authorities. These special events, sponsored by organizations that meet regularly with the AAAS, are

joint sessions with the Association and are open to the general public of the city in which the meeting is held.

I. **Saturday evening, Dec. 27, Crystal Room, Hotel Jefferson, 8:30 p.m.** United Chapters of Phi Beta Kappa.
Speaker: RICHARD H. SHRYOCK, Institute of the History of Medicine, The Johns Hopkins University.
Subject: The Interplay of Social and Internal Factors in the History of Science: As Illustrated in Modern Medicine.
ARTHUR HOLLY COMPTON, chancellor, Washington University, will preside.

II. **Saturday evening, Dec. 27, Room 100, Brown Hall, Washington University, 8:00 p.m.** American Mathematical Society Josiah Willard Gibbs Lecture.
Speaker: MARSTON MORSE, Institute for Advanced Study, Princeton, N. J.
Subject: Topology and Geometrical Analysis.
JOHN VON NEUMANN, Institute for Advanced Study, president of the society, will preside.

III. **Sunday evening, Dec. 28, Gold Room, Hotel Jefferson, 8:00 p.m.** AAAS Presidential Address.
Speaker: KIRTLEY F. MATHER, chairman of the Department of Geology, Harvard University, and retiring president of the Association.
Subject: The Common Ground of Science and Politics.
DETLEV W. BRONK, president, The Johns Hopkins University, and president of the Association, will preside.
Preceding the address, CHARLES ALLEN THOMAS, president, Monsanto Chemical Company, and general chairman of the St. Louis Reception Committee, will speak briefly.
Following the address there will be an informal AAAS Presidential Reception in the adjacent Crystal Room. All registrants and members of the Local Committee are cordially invited to attend.

IV. **Monday evening, Dec. 29, Gold Room, Hotel Jefferson, 8:15 p.m.** Society of the Sigma Xi.
Speaker: D. M. S. WATSON, professor emeritus of zoology, University of London, and Alexander Agassiz professor of zoology, Museum of Comparative Zoology, Harvard University.
Subject: Africa and the Origin of Man (Illustrated).
HUGH S. TAYLOR, dean of the Graduate School, Princeton University, and president of the society, will preside.

V. **Monday evening, Dec. 29, Opera House, Kiel Auditorium, 8:15 p.m.** National Geographic Society.
Speaker: W. ROBERT MOORE, Foreign Editorial Staff, National Geographic Society.
Subject: Sunshine and Eclipse over Nigeria and Sudan (Illustrated).
KIRTLEY F. MATHER will preside.

VI. **Tuesday evening, Dec. 30, Gold Room, Hotel Jefferson, 8:00 p.m.** Scientific Research Society of America.
Speaker: SHIELDS WARREN, Cancer Research Institute, New England Deaconess Hospital, Boston.
Subject: The Contribution of Atomic Energy to Health.
KARL T. COMPTON, chairman, Corporation of Massachusetts Institute of Technology, and chairman of the society, will preside.

AAAS Science Theatre Programs

The AAAS Science Theatre, a permanent feature of the Association's annual meetings, presents showings of the latest domestic and foreign scientific films—nearly all with sound—throughout the meeting period. Please note, in the following schedule, that programs are both repeated and transposed to increase the opportunities to see particular films. Most titles—but not all—will be shown twice. The Association is greatly indebted to all those who made these pictures and lent them for showing.

The AAAS Science Theatre is in Room C of the Kiel Municipal Auditorium, a room which seats 225 comfortably. It is entered from the exhibit area of the Annual Exposition of Science and Industry or from the wide semicircular corridor containing the Main Registration. Enter the 14th St. Lobby of the Kiel Auditorium and proceed up the ramp to the second floor.

The Science Theatre is a feature for the pleasure and information of all registrants attending the Annual Meeting, and it is deemed well worth the considerable projection costs. It cannot be for the casual passer-by; thus, admission is restricted to those who wear the AAAS Convention Badge—or who show an Association Registration Receipt.

Hours

Saturday, Dec. 27	2:00 P.M.–6:00 P.M.
Sunday, Dec. 28	2:00 P.M.–6:00 P.M.
Monday, Dec. 29	8:00 A.M.–noon; 2:00 P.M.–6:00 P.M.
Tuesday, Dec. 30	8:00 A.M.–noon; noon–4:00 P.M.

PROGRAM 1

Saturday Afternoon, Dec. 27, 2:00 P.M.–6:00 P.M.

1. TERRA INCOGNITA. North American Philips Company, Inc. Black-and-white. 20 min.
2. CARBON FOURTEEN. Encyclopaedia Britannica Films, Inc. Color. 12 min.
3. THE AUTONOMIC NERVOUS SYSTEM. J. E. Markee and R. Frederick Becker, Duke University. Color. 42 min.
4. THE DANCE OF THE BEES. Karl von Frisch. Black-and-white. Silent. 22 min.
5. WANDOROBA. American Museum of Natural History. Color. 30 min.
6. PLAN TO LIVE. Indiana University. Black-and-white. 18 min.
7. TEHACHAPI EARTHQUAKE DAMAGE AND REPAIR. Southern Pacific Company. Color. 11 min.
8. INSIDE THE CELL, PART I—ENZYMES IN INTRACELLULAR CHEMISTRY. Department of the Army. Color. 40 min.
9. OIL THE INVISIBLE TRAVELER. Shell Oil Company. Color. 20 min.

PROGRAM 2

Sunday Afternoon, Dec. 28, 2:00 P.M.–6:00 P.M.

1. SCIENCE IN THE ORCHESTRA. British Information Services. Black-and-white. 35 min.
2. THE ATOM AND INDUSTRY. Encyclopaedia Britannica Films, Inc. Black-and-white. 12 min.
3. BREAKDOWN. National Film Board of Canada. Black-and-white. 40 min.
4. PLANT GROWTH AND MUTATION IN *Tradescantia Virginica* L. Arthur T. Price. Black-and-white. 11 min.
5. THE JET STORY. General Electric Company. Black-and-white. 15 min.
6. STEPS OF AGE. Mental Health Film Board; (MHFB films exclusively distributed by the International Film Bureau, Inc.). Black-and-white. 25 min.
7. INSIDE THE CELL, PART II—REGULATION OF ENZYMES. Department of the Army. Color. 43 min.
8. EXPERIMENTAL FILM ON AIR BLAST CONTROL OF GASOLINE SPILLAGE FIRES. Parks College of Saint Louis University. Color. Silent. 20 min.

9. Effects of Beta and X-Irradiation in the Hamster Cheek Pouch. G. P. Fulton, B. R. Lutz, D. Joftes, F. Maynard, Boston University. Color. Silent. 15 min.

Program 3

Monday Morning, Dec. 29, 8:00 A.M.–Noon.

1. Aborigines of the Sea Coast. Australian News and Information Bureau. Color. 25 min.
2. A Story of Copper. Bureau of Mines. Color. 33 min.
3. Giving the Rorschach Test: Klopfer Method. Miriam Siegel and Ruth Monroe. Black-and-white. 9 min.
4. Uterine Cancer: The Problem of Early Diagnosis. American Cancer Society. Color. 21 min.
5. Padirac. French Embassy. In French. Black-and-white. 18 min.
6. Oak Wilt in Wisconsin. University of Wisconsin. Color. Silent. 20 min.
7. Shackles for the Giant. Mississippi River Commission. Color. 25 min.
8. Harnessed Lightning. General Motors Corporation. Color. 25 min.
9. Birds and Billabongs. Australian News and Information Bureau. Color. 12 min.
10. Powering America's Progress—A Modern Story of Bituminous Coal. Bureau of Mines. Color. 25 min.

Program 4

Monday Afternoon, Dec. 29, 2:00 P.M.–6:00 P.M.

Same as Program 1.

Program 5

Tuesday Morning, Dec. 30, 8:00 A.M.–Noon.

Same as Program 2.

Program 6

Tuesday Afternoon, Dec. 30, Noon–4:00 P.M.

1. Whistle in the Night. Association Films, Incorporated. Black-and-white. 15 min.
2. Some Creatures of the Barrier Reef. Australian News and Information Bureau. Color. 10 min.
3. Experimental Neurosis in Monkeys. J. M. Masserman and Curtis Pechtel. Black-and-white. 19 min.
4. World Gardens. British Information Service. Color. 11 min.
5. The Biology of Domestic Flies. U. S. Public Health Service. Black-and-white. 9 min.
6. California and its Natural Resources. Bureau of Mines. Color. 40 min.
7. Snow on the Run. Southern Pacific Company. Color. 22 min.
8. Notornis Expedition. New Zealand Embassy. Black-and-white. 11 min.
9. A Story of Copper. Bureau of Mines. Color. 33 min.
10. Shackles for the Giant. Mississippi River Commission. Color. 25 min.
11. Uterine Cancer: The Problem of Early Diagnosis. American Cancer Society. Color. 21 min.

The St. Louis Reception Committee

It would be impossible to make successful arrangements for the large and complex meetings of the Association, to ensure the smooth operation of each session, to secure adequate local public information—indeed, to finance the meetings—without the very considerable personal services of the members of the local committee. They merit the unstinted appreciation of all who attend. In making the 119th meeting a successful and memorable one, those whose names follow have advanced science.

General Chairman

Charles Allen Thomas, President, Monsanto Chemical Company

Vice Chairmen

Warren K. Begeman, director, Adult and Technical Education, St. Louis Board of Education
Leslie J. Buchan, vice chancellor and dean of faculties, Washington University.
Howard A. Marple, director, Advertising and Public Relations, Monsanto Chemical Company

Executive Committee

Howard F. Baer, president, A. S. Aloe Company
Frank R. Bradley, director, Barnes Hospital
August A. Busch, Jr., president, Anheuser-Busch, Inc.
David R. Calhoun, president, St. Louis Union Trust Company
Arthur H. Compton, chancellor, Washington University
Victor E. Cooley, chairman, Southwestern Bell Telephone Company
Donald Danforth, president, Ralston Purina Company
Donald V. Fraser, president, Missouri-Kansas-Texas Railroad Co.
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Edward Mallinckrodt, chairman, Mallinckrodt Chemical Works
J. Wesley McAfee, president, Union Electric Company of Missouri
James S. McDonnell, president, McDonnell Aircraft Corporation
Lamar W. McLeod, vice president, Westinghouse Electric Corporation
John M. Olin, president, Olin Industries, Inc.
Joseph Pulitzer, president, St. Louis *Post-Dispatch*
Edgar E. Rand, president, International Shoe Company
Very Reverend Paul C. Reinert, president, Saint Louis University
Oscar C. Schmitt, president, The Emerson Electric Manufacturing Company
John K. Wallace, president, Cupples Company
Howard I. Young, president, American Zinc, Lead and Smelting Company

General Service Subcommittee

Warren K. Begeman, *Chairman*
Reverend Raymond J. Bishop, S. J., director, Department of Education, Saint Louis University
Philip Brante, assistant building commissioner, St. Louis Board of Education
Dorothy Cutter, Visual Education, Roosevelt High School
Herald M. Doxsee, Visual Education, Cleveland High School
Herbert J. Hicks, Visual Education, Central High School
Leon L. Katzenstein, Visual Education, Hadley Technical High School
Victor H. Kirk, Visual Education, Beaumont High School
Louise Langenohl, Visual Education, Southwest High School
Leslie W. Lyon, Visual Education, Soldan-Blewett High School
Alfred Mack, head of Automechanics Department, Hadley Technical High School
Gould Meenach, Radio Education, Southwest High School

ROSS R. MIDDLEMISS, professor of mathematics, Washington University
CLARENCE POTTHOFF, supervisor of transportation, St. Louis Board of Education
JOSEPH STEURER, superintendent of landscapes, St. Louis Board of Education

Subcommittee on Local Public Information

HOWARD A. MARPLE, *Chairman*
D. C. CRONIN, manager, Advertising and Sales Promotion, Olin Industries, Inc., East Alton, Ill.
OTIS O. MCINTOSH, director of public relations, Ralston Purina Company
DOUGLAS WILLIAMS, vice president in charge of public relations, Southwestern Bell Telephone Company

SUMMARY OF EVENTS

Friday, December 26

(The AAAS Annual Exposition of Science and Industry opens Saturday morning, and the AAAS Science Theatre opens Saturday afternoon. The Visible Directory of Registrants in the Kiel Auditorium is open 8:00 A.M. till 6:00 P.M.)

Friday Afternoon

Chemistry

C *Section on Chemistry*—2:00 P.M., Papers, Crystal Room, Jefferson.

Friday Evening

AAAS as a Whole

AAAS Executive Committee Meeting—8:00 P.M., Suite of the Administrative Secretary, Jefferson.

Saturday, December 27

Saturday Morning

AAAS as a Whole

AAAS General Symposium—Disaster Recovery
Part I: The Nature of Disasters, 9:30 A.M., Assembly Hall 1, Kiel Auditorium.

X5, M, Q1 *Conference on Scientific Manpower II, Section on Engineering, AAAS Cooperative Committee on the Teaching of Science and Mathematics,* and *the Engineering Manpower Commission*—9:30 A.M., Conference on Scientific Manpower, Part I: Current Research on Scientific Manpower, Room 4B, Kiel Auditorium.

Mathematics

A1 *American Mathematical Society*—9:00 A.M., Concurrent Session A, Room 118, Brown Hall; Concurrent Session B, Louderman Auditorium; Concurrent Session C, Room 112, Wilson Hall, Washington University; 10:30 A.M., Concurrent Session A, Room 118, Brown Hall; Concurrent Session B, Louderman Auditorium; Concurrent Session C, Room 112, Wilson Hall, Washington University.

Chemistry

C *Section on Chemistry*—9:15 A.M., Concurrent Session 1, Symposium: The New Synthetic Fibers, Part I, Room 3A, Kiel Auditorium; 8:45 A.M., Concurrent Session 2, Symposium: Contributions of Chemistry in the Field of Human and Animal Nutrition, Part I, Room 3B, Kiel Auditorium.

Zoological Sciences

F2 *Society of Systematic Zoology*—9:30 A.M., Council Meeting I, Ballroom Assembly South, Statler.

Botanical Sciences

G *Section on Botanical Science*—10:00 A.M., Papers, Room 3D, Kiel Auditorium.

Anthropology

H *Section on Anthropology*—9:30 A.M., Symposium: The Rio Grande Pueblos and the Plains, Part I, Room 4D, Kiel Auditorium.

Psychology

I, M, Nm, P *Section on Psychology, Section on Engineering, Subsection on Medicine,* and *Section on Industrial Science*—9:30 A.M., Symposium: Men and Machines, Part I: How Can We Fit Man to the Industrial Situation? Assembly Hall 2, Kiel Auditorium.

Social and Economic Sciences

K, O *Section on Social and Economic Sciences,* and *Section on Agriculture*—9:00 A.M., Symposium: Combined Resource Development with Special Reference to the Missouri Valley, Part I, Room 4C, Kiel Auditorium.

Medical Sciences

Nm *Subsection on Medicine*—10:00 A.M., Symposium: Fluid and Saline Therapy, Assembly Hall 3, Kiel Auditorium.

Nd *Subsection on Dentistry*—9:00 A.M., Symposium: The Chemistry of Saliva, Room B, Kiel Auditorium.

Industrial Science

P, P2 *Section on Industrial Science,* and *Society for Industrial Microbiology*—9:30 A.M., Symposium: Industrial Microbiology, Part I, Room 3C, Kiel Auditorium.

Education

FG4 *National Association of Biology Teachers*—8:00 A.M., Meeting of Board of Directors, Parlor A, De Soto.

FG4, Q4, X4 *National Association of Biology Teachers, National Science Teachers Association,* and *American Nature Study Society*—8:30 A.M., Science Teaching Films, De Soto Room, De Soto; 10:00 A.M., Implementation of Basic Principles of Good Teaching, De Soto Room, De Soto.

X4 *American Nature Study Society*—8:00 A.M., Meeting of Board of Directors, Parlor B, De Soto.

Saturday Afternoon

AAAS as a Whole

AAAS General Symposium—Disaster Recovery, Part II: Disaster Recovery, 2:00 P.M., Assembly Hall 1, Kiel Auditorium.

AAAS Council Meeting I—4:00 P.M., Private Dining Room 1, Jefferson.

Mathematics

A1 *American Mathematical Society*—2:00 P.M., Address, Room 100, Brown Hall, Washington University; 3:30 P.M., Concurrent Session A, Room 118, Brown Hall; Concurrent Session B, Louderman Auditorium: Concurrent Session C, Room 112, Wilson Hall, Washington University.

Chemistry

C *Section on Chemistry*—2:00 P.M., Concurrent Session 1, Symposium: The New Synthetic Fibers, Part II, Room 3A, Kiel Auditorium; Concurrent Session 2, Symposium: Contributions of Chemistry in the Field of Human and Animal Nutrition, Part II, Room 3B, Kiel Auditorium.

Geology and Geography

E3 *National Speleological Society*—2:00 P.M., Papers, Parlor A, Statler.

Zoological Sciences

F, F2 *Section on Zoological Sciences* and *Society of*

Systematic Zoology—2:00 P.M., Public Book Discussion Panel: *Time's Arrow and Evolution*, Ballroom, Statler; 4:00 P.M., Public Book Discussion Panel: *The Meaning of Evolution*, Ballroom, Statler.

Botanical Sciences

G, FG2 *Section on Botanical Sciences* and *Ecological Society of America*—2:00 P.M., Plant Ecological Papers, Room 3D, Kiel Auditorium.

Anthropology

H *Section on Anthropology*—2:00 P.M., Symposium: The Rio Grande Pueblos and the Plains, Part II, Room 4D, Kiel Auditorium.

Psychology

I, M, Nm, P *Section on Psychology, Section on Engineering, Subsection on Medicine,* and *Section on Industrial Science*—2:00 P.M., Symposium: Men and Machines, Part II—How Can We Fit the Machine to Modern Man? Assembly Hall 2, Kiel Auditorium.

Social and Economic Sciences

K, O *Section on Social and Economic Sciences* and *Section on Agriculture*—2:00 P.M., Symposium: Combined Resource Development with Special Reference to the Missouri Valley, Part II, Room 4C, Kiel Auditorium.

Medical Sciences

Nm *Subsection on Medicine*—2:00 P.M., Symposium: Chemotherapy of Tuberculosis, Assembly Hall 3, Kiel Auditorium.

Nd *Subsection on Dentistry*—2:00 P.M., Symposium: Scientific Contributions to the Manufacture of Restorative Dental Materials, Room B, Kiel Auditorium.

Industrial Science

P, P2 *Section on Industrial Science* and *Society for Industrial Microbiology*—2:00 P.M., Symposium: Industrial Microbiology, Part II, Room 3C, Kiel Auditorium.

Education

FG4, Q4, X4 *National Association of Biology Teachers, National Science Teachers Association,* and *American Nature Study Society*—2:00 P.M., Implementation of Objectives with Retarded and with Superior Science Students, De Soto Room, De Soto.

Saturday Evening

AAAS as a Whole

X10 United Chapters of Phi Beta Kappa: Annual Address, 8:30 P.M., Crystal Room, Jefferson.

Mathematics

A1 *American Mathematical Society*—8:00 P.M., Josiah Willard Gibbs Lecture, Room 100, Brown Hall, Washington University.

Zoological Sciences

F, F2 *Section on Zoological Sciences* and *Society of Systematic Zoology*—8:00 P.M., Symposium: Life History Studies in Relation to Systematics, Ballroom, Statler.

Medical Sciences

Nd *Subsection on Dentistry*—8:00 P.M., Symposium: Engineering and Chemical Factors of Water Fluoridation, Missouri Room, Statler.

Education

FG4, Q4, X4 *National Association of Biology Teachers, National Science Teachers Association,* and *American Nature Study Society*—6:00 P.M., Science Teachers Banquet, Cotillion Room, De Soto; 8:00 P.M., ANSS Presidential Address, De Soto Room, De Soto; 9:30 P.M., All-Societies Mixer, De Soto Room, De Soto.

Sunday, December 28

Sunday Morning

AAAS as a Whole

X1 *Academy Conference*—9:00 A.M., Business Meeting, Private Dining Room 7, Jefferson; 11:00 A.M., Round Table Discussion, Private Dining Room 7, Jefferson.

X5, M, Q1 *Conference on Scientific Manpower II, Section on Engineering, AAAS Cooperative Committee on the Teaching of Science and Mathematics,* and *Engineering Manpower Commission*—9:30 A.M., Conference on Scientific Manpower, Part II: The National Science Foundation Program in Scientific Personnel and Education, Room 4B, Kiel Auditorium.

Mathematics

A1 *American Mathematical Society*—9:00 A.M., Concurrent Session A, Room 118, Brown Hall; Concurrent Session B, Louderman Auditorium; Concurrent Session C, Room 112, Wilson Hall, Washington University; 10:30 A.M., Concurrent Session A, Room 118, Brown Hall; Concurrent Session B, Louderman Auditorium; Concurrent Session C, Room 112, Wilson Hall, Washington University.

A3 *Mathematical Association of America*—9:00 A.M., Meeting of Executive and Finance Committees, Library, Women's Building, Washington University.

Chemistry

C, Nm *Section on Chemistry* and *Subsection on Medicine*—9:15 A.M., Concurrent Session 1, Symposium: Contributions of Chemistry to Medicine, Room 3A, Kiel Auditorium.

C, Nd *Section on Chemistry* and *Subsection on Dentistry*—9:15 A.M., Concurrent Session 2, Symposium: Chemistry and Dentistry Team Up for Progress, Part I, Room 3B, Kiel Auditorium.

Zoological Sciences

F *Section on Zoological Sciences*—9:30 A.M., Business Meeting, Ballroom Assembly South, Statler.

F2 *Society of Systematic Zoology*—10:00 A.M., Business Meeting, Ballroom Assembly South, Statler; 11:00 A.M., Council Meeting II, Ballroom Assembly South, Statler.

Botanical Sciences

G *Section on Botanical Sciences*—10:00 A.M., Symposium: Improvement in the Teaching of Taxonomy, Museum Building, Missouri Botanical Garden.

Anthropology

H *Section on Anthropology*—9:30 A.M., Papers: Cultural Anthropology, Room 4D, Kiel Auditorium.

Social and Economic Sciences

K, O *Section on Social and Economic Sciences* and *Section on Agriculture*—9:00 A.M., Symposium: Combined Resource Development with Special Reference to the Missouri Valley, Part III, Room 4C, Kiel Auditorium.

Industrial Science

P2 *Society for Industrial Microbiology*—9:30 A.M., Papers, Crystal Room, Jefferson.

Education

FG4, X4 *National Association of Biology Teachers*

and *American Nature Study Society*—9:00 A.M., Departure of Field Trip, Lobby, De Soto.

G4 *National Science Teachers Association*—9:00 A.M., Meeting of Executive Committee, Parlor C, De Soto.

Sunday Noon and Afternoon

AAAS as a Whole

X1 *Academy Conference*—1:30 P.M., Round Table Discussion, Private Dining Room 7, Jefferson.

X6 *Conference on Scientific Editorial Problems*—2:00 P.M., Conference on Scientific Editorial Problems, Room 4B, Kiel Auditorium.

Mathematics

A1 *American Mathematical Society*—2:00 P.M., Presidential Address, Room 100, Brown Hall, Washington University; 3:30 P.M., Concurrent Session A, Room 118, Brown Hall; Concurrent Session B, Louderman Auditorium; Concurrent Session C, Room 112, Wilson Hall, Washington University; 3:30 to 5:30 P.M., Tea, Lounge, Women's Building, Washington University.

Chemistry

C, Nm *Section on Chemistry* and *Subsection on Medicine*—2:00 P.M., Concurrent Session 1, Symposium: Contributions of Chemistry to the Cancer Problem, Room 3A, Kiel Auditorium.

C, Nd *Section on Chemistry* and *Subsection on Dentistry*—2:00 P.M., Concurrent Session 2, Symposium: Chemistry and Dentistry Team Up for Progress, Part II, Room 3B, Kiel Auditorium.

Zoological Sciences

F, F2, L *Section on Zoological Sciences, Society of Systematic Zoology,* and *Section on History and Philosophy of Science*—3:00 P.M., Symposium: Anecdotal Sketches of Famous Zoologists, Ballroom, Statler.

Botanical Sciences

G *Section on Botanical Sciences*—12:00 noon, Luncheon, Museum Building, Missouri Botanical Garden; 2:00 P.M., Symposium: Biosystematics and Taxonomic Units, Museum Building, Missouri Botanical Garden.

Anthropology

H *Section on Anthropology*—2:00 P.M., Papers: Archaeology, Room 4D, Kiel Auditorium.

Social and Economic Sciences

K, O *Section on Social and Economic Sciences* and *Section on Agriculture*—2:00 P.M., Symposium: Combined Resource Development with Special Reference to the Missouri Valley, Part IV, Room 4C, Kiel Auditorium.

History and Philosophy of Science

L *Section on History and Philosophy of Science*—2:30 P.M., Symposium: Relations between Science and Thomistic Philosophy, Room 3C, Kiel Auditorium.

Medical Sciences

N4 *Alpha Epsilon Delta, National Premedical Honor Society*—12:30 P.M., Luncheon, Daniel Boone Room, Statler.

N4, Nm, K, Q *Alpha Epsilon Delta, Subsection on Medicine, Section on Social and Economic Sciences,* and *Section on Education*—2:00 P.M., Symposium: The Social Sciences and Humanities in Medical Education, Missouri Room, Statler.

N7 *American Association of Hospital Consultants*—2:30 P.M., Symposium: Science and Medical Care, Room 3D, Kiel Auditorium.

N10 *American Physiological Society*—2:00 P.M., Symposium: Education in Physiological Science, Part I, St. Louis Room, Statler.

Industrial Science

P2 *Society for Industrial Microbiology*—2:00 P.M., Papers, Crystal Room, Jefferson.

Education

Q1, Q4, FG4, X4 *AAAS Cooperative Committee on the Teaching of Science and Mathematics, National Science Teachers Association, National Association of Biology Teachers,* and *American Nature Study Society*—1:30 P.M., Identification of Talented Youth in Science and Mathematics, Parlor D, De Soto.

Sunday Evening

AAAS as a Whole

X1 *Academy Conference*—6:00 P.M., Academy Conference Dinner, Private Dining Room 2, Jefferson.

AAAS Presidential Address—8:00 P.M., Gold Room, Jefferson.

AAAS Reception—9:00 P.M., Crystal Room, Jefferson.

Mathematics

A1 *American Mathematical Society*—8:00 P.M., Council Meeting; Lounge, Brown Hall, Washington University; 8:00 P.M., Opera Workshop Performance by Washington University Department of Music, Room 100, Brown Hall.

A3 *Mathematical Association of America*—7:00 P.M., Meeting of Section Officers, Room 107, Brown Hall, Washington University.

Zoological Sciences

F, F2 *Section on Zoological Sciences* and *Society of Systematic Zoology*—7:30 P.M., Motion Picture: *The Last Frontier,* Ballroom, Statler.

Anthropology

H *Section on Anthropology*—6:00 P.M., Anthropologists' Dinner, Private Dining Room 8, Jefferson; 7:30 P.M., Vice-Presidentinl Address of Section H, Private Dining Room 9, Jefferson.

Medical Sciences

N10 *American Physiological Society*—8:00 P.M., Symposium: Education in Physiological Science, Part II, St. Louis Room, Statler.

Education

FG4 *National Association of Biology Teachers*—8:00 P.M., Meeting of Board of Directors, Parlor A, De Soto.

X1 *Academy Conference*—7:30 P.M., Junior Scientists Assembly, Cotillion Room, De Soto.

Monday, December 29

Monday Morning

AAAS as a Whole

AAAS General Symposium—Applications of the Theory of Games, 10:00 A.M., Assembly Hall 1, Kiel Auditorium.

X5, M, Q1 *Conference on Scientific Manpower II, Section on Engineering, AAAS Cooperative Committee on the Teaching of Science and Mathematics,* and *Engineering Manpower Commission*—9:30 A.M., Conference on Scientific Manpower, Part III: Scientists and Engineers in the Defense Program, Room 4B, Kiel Auditorium.

Mathematics

A1 *American Mathematical Society*—9:00 A.M., Concurrent Session A, Room 118, Brown Hall; Concurrent

Session B, Room 101, Crow Hall; Concurrent Session C, Room 104, Crow Hall, Washington University; 10:30 A.M., Concurrent Session A, Room 118, Brown Hall; Concurrent Session B, Room 101, Crow Hall; Concurrent Session C, Room 104, Crow Hall, Washington University.

A2 *Association for Symbolic Logic*—9:00 A.M., Papers, Room 106, Crow Hall, Washington University; 10:30 A.M., Presidential Address, Room 106, Crow Hall.

A3 *Mathematical Association of America*—9:00 A.M., Meeting of Board of Governors, Room 107, Brown Hall, Washington University.

Physics

B, B2, M, P *Section on Physics, Oak Ridge Institute of Nuclear Studies, Section on Engineering,* and *Section on Industrial Science*—9:00 A.M., Symposium: Nuclear Science in Industry, Room 4C, Kiel Auditorium.

Chemistry

C *Section on Chemistry*—10:00 A.M., Papers commemorating the Centenary of Washington University, Room 111, Louderman Hall, Washington University.

Geology and Geography

E, E1 *Section on Geology and Geography* and *Geological Society of America*—9:00 A.M., Symposium: Modern Research of State Geological Surveys and its Economic Values, Part I, Room 3A, Kiel Auditorium.

Zoological Sciences

F *Section on Zoological Sciences*—10:00 A.M., Papers: Physiology, Parlor A, Statler.

F2 *Society of Systematic Zoology*—10:00 A.M., Concurrent Session 1, Papers: Evolution and Classification, Ballroom Assembly South, Statler; Concurrent Session 2, Papers: General Systematics, Room 102, Statler.

Botanical Sciences

G, G1, FG1 *Section on Botanical Sciences; Illinois Section, American Society of Plant Physiologists*; and *American Society of Naturalists*—9:30 A.M., Symposium: Nitrogen Metabolism in the Green Plant, Part I, Room 3B, Kiel Auditorium.

Psychology

I *Section on Psychology*—9:00 A.M., Papers: Clinical Psychology, Room 4D, Kiel Auditorium.

Social and Economic Sciences

K, H *Section on Social and Economic Sciences* and *Section on Anthropology*—10:00 A.M., Symposium: Social and Economic Aspects of Technical Assistance Programs, Part I, Room B, Kiel Auditorium.

Engineering

L, M, P, L1 *Section on History and Philosophy of Science, Section on Engineering, Section on Industrial Science,* and *Philosophy of Science Association*—9:30 A.M., Symposium: Methodology of Engineering Research, Room 3C, Kiel Auditorium.

Medical Sciences

F, G, F3, N, N13, N15 *Section on Zoological Sciences; Section on Botanical Sciences; Saint Louis University Institute of Biophysics; Section on Medical Sciences; Missouri Division, American Cancer Society*; and *Society of General Physiologists*—9:00 A.M., Symposium: Survival of Frozen Tissues, Part I: Basic Problems and Surgical Applications, Assembly Hall 2, Kiel Auditorium.

Np, N6, N8, N9, N12 *Subsection on Pharmacy; American Association of Colleges of Pharmacy; American College of Apothecaries; American Pharmaceutical Association, Scientific Section*; and *American Society of Hospital Pharmacists*—9:00 A.M., Greetings and Messages, Papers, Room 3D, Kiel Auditorium.

N5 *American Academy of Forensic Sciences*—9:15 A.M., Symposium: Problems in Forensic Sciences, Part I, Room 4A, Kiel Auditorium.

N11 *American Psychiatric Association*—9:00 A.M., Papers, St. Louis Room, Statler.

Industrial Science

P1, Nm, P *American Industrial Hygiene Association, Subsection on Medicine,* and *Section on Industrial Science*—10:00 A.M., Symposium: Industrial Hygiene—An Applied Science, and Vice-Presidential Address of Section N, Assembly Hall 3, Kiel Auditorium.

Education

FG4 *National Association of Biology Teachers*—8:00 A.M., Meeting of Editorial Board, *American Biology Teacher,* Parlor A, De Soto.

FG4, Q4, X4 *National Association of Biology Teachers, National Science Teachers Association,* and *American Nature Study Society*—8:30 A.M., Science Teaching Films, De Soto Room, De Soto.

FG4 *National Association of Biology Teachers*—10:00 A.M., Papers, Gold Room, Jefferson.

Q *Section on Education*—9:30 A.M., Panel: Visual Performance Engineering in Industry and in the School, Part I, Private Dining Room 3, Jefferson.

Q, Q1, Q4 *Section on Eduation, AAAS Cooperative Committee on the Teaching of Science and Mathematics,* and *National Science Teachers Association*—9:00 A.M., Symposium: A Report of Research on the New York State Regents Science Examinations, Ivory Room, Jefferson.

Q4 *National Science Teachers Association*—10:00 A.M., Concurrent Session 1, Reports from Inside NSTA, De Soto Room, De Soto; Concurrent Session 2, Business Meeting, Business-Industry Section, Parlor D, De Soto.

X4 *American Nature Study Society*—10:00 A.M., Session, Hunt Room, De Soto.

Monday Noon and Afternoon

Mathematics

A1 *American Mathematical Society*—2:00 P.M., Business Meeting, Room 100, Brown Hall, Washington University.

A and A1 *Section on Mathematics* and *American Mathematical Society*—3:30 P.M., Vice-Presidential Address of Section A, Room 100, Brown Hall, Washington University; 3:30 to 5:30 P.M., Tea, Lounge, Women's Building, Washington University.

A2 *Association for Symbolic Logic*—3:30 P.M., Papers, Room 104, Crow Hall, Washington University.

A1 *American Mathematical Society*—5:00 P.M., Concurrent Session A, Room 101, Crow Hall; Concurrent Session B, Room 104, Crow Hall; Concurrent Session C, Room 106, Crow Hall, Washington University.

Physics

B2 *Oak Ridge Institute of Nuclear Studies*—12:30 P.M., ORINS Luncheon, Private Dining Room 7, Jefferson.

B, B2 *Section on Physics* and *Oak Ridge Institute of Nuclear Studies*—2:00 P.M., Symposium: Research Applications of Carbon 14, Room 4C, Kiel Auditorium.

Chemistry

C *Section on Chemistry*—12:15 P.M., Luncheon, Washington University Dining Rooms; 1:45 P.M., Dedication of Louderman Hall, Room 111, Louderman Hall, Washington University.

Astronomy

D *Section on Astronomy*—2:00 P.M., Papers, Private Dining Room 8, Jefferson.

D, D1 *Section on Astronomy*; and *Astronomical League, Mid-States Region*—3:00 P.M., Contributions of the Amateur Astronomer to the Advancement of Astronomy, Private Dining Room 8, Jefferson.

Geology and Geography

E, E1 *Section on Geology and Geography* and *Geological Society of America*—2:00 P.M., Symposium: Modern Research of State Geological Surveys and its Economic Values, Part II, Room 3A, Kiel Auditorium.

Zoological Sciences

F, F2 *Section on Zoological Sciences* and *Society of Systematic Zoology*—2:00 P.M., Public Book Discussion Panel: Three General College Biology Texts, Ballroom, Statler.

F2 *Society of Systematic Zoology*—4:00 P.M., Council Meeting III, Parlor A, Statler.

Botanical Sciences

G, G1, FG1 *Section on Botanical Sciences; Illinois Section, American Society of Plant Physiologists*; and *American Society of Naturalists*—2:00 P.M., Symposium: Nitrogen Metabolism in the Green Plant, Part II, Room 3B, Kiel Auditorium.

G, FG2, FG3 *Section on Botanical Sciences, Ecological Society of America*, and *Grassland Research Foundation*—2:00 P.M., Symposium: The Western Range—Our Great Natural Resource, Room 4B, Kiel Auditorium.

Psychology

I *Section on Psychology*—1:00 P.M., Papers: Clinical Psychology, Room 4D, Kiel Auditorium; 3:00 P.M., Papers: Training, Room 4D, Kiel Auditorium.

K, H *Section on Social and Economic Sciences* and *Section on Anthropology*—2:00 P.M., Symposium: Social and Economic Aspects of Technical Assistance Programs, Part II, Room B, Kiel Auditorium.

K, K1, P, K2 *Section on Social and Economic Sciences, National Academy of Economics and Political Science, Section on Industrial Science*, and *Pi Gamma Mu*—2:00 P.M., Symposium: Information Processing in Social and Industrial Research, Private Dining Room 9, Jefferson.

History and Philosophy of Science

L, L1 *Section on History and Philosophy of Science* and *Philosophy of Science Association*—2:00 P.M., Symposium: Leonardo da Vinci, Room 3C, Kiel Auditorium.

Medical Sciences

F, F3, N, N13, N14, N15 *Section on Zoological Sciences; Saint Louis University Institute of Biophysics; Section on Medical Sciences; Missouri Division, American Cancer Society; Saint Louis University School of Dentistry, Department of Pathology*; and *Society of General Physiologists*—2:00 P.M., Symposium: Survival of Frozen Tissues, Part II, Survival of Frozen Tumor Tissues, Assembly Hall 2, Kiel Auditorium.

Nm, M, P, P1 *Subsection on Medicine, Section on Engineering, Section on Industrial Science*, and *American Industrial Hygiene Association*—2:00 P.M., Symposium: Health Hazards and Health Protection, Part I: Food Protection, Assembly Hall 3, Kiel Auditorium.

Np, N6, N8, N9, N12 *Subsection on Pharmacy; American Association of Colleges of Pharmacy; American College of Apothecaries; American Pharmaceutical Association, Scientific Section*; and *American Society of Hospital Pharmacists*—1:45 P.M., Papers, Room 3D, Kiel Auditorium; 2:15 P.M., Symposium: Accreditation of Hospital Pharmacies, Approval of Pharmacy Interne and Residency Programs, Room 3D, Kiel Auditorium.

N5 *American Academy of Forensic Sciences*—2:00 P.M., Symposium: Problems in Forensic Sciences, Part II, Room 4A, Kiel Auditorium.

N11 *American Psychiatric Association*—2:00 P.M., Round Table Discussion: Personality of Scientific Investigators, Room 102, Statler.

Education

FG4 *National Association of Biology Teachers*—12:30 P.M., Luncheon and Address, Hunt Room, De Soto.

FG4, Q3 *National Association of Biology Teachers* and *National Association for Research in Science Teaching*—2:00 P.M., Papers, De Soto Room, De Soto.

Q *Section on Education*—2:00 P.M., Concurrent Session 1, Panel: Visual Performance Engineering in Industry and in the School, Part II, Private Dining Room 3, Jefferson; Concurrent Session 2, Papers, Private Dining Room 2, Jefferson.

Q4 *National Science Teachers Association*—12:00 noon, Luncheon of the Business–Industry Section, Garden Room, Lennox; 2:00 P.M., Concurrent Session 1, Business–Industry Section, Parlor D, De Soto; Concurrent Session 2, Improving the Program for Science in General Education at Senior High School and Junior College Levels, Ballroom Assembly South, Statler; Concurrent Session 3, Improving the Program for Science in General Education at Elementary and Junior High School Levels, Daniel Boone Room, Statler.

X4 *American Nature Study Society*—2:00 P.M., Panel: Presenting Nature and Conservation through the Major Mediums of Public Enlightenment, Missouri Room, Statler.

X8 *Scientific Research Society of America*—4:00 P.M., Annual Convention, Ivory Room, Jefferson.

X9 *Society of the Sigma Xi*—2:00 P.M., Annual Convention, Ivory Room, Jefferson.

Monday Evening

AAAS as a Whole

X9 *Society of the Sigma Xi*: Annual Address, 8:15 P.M., Gold Room, Jefferson.

E2 *National Geographic Society*: Annual Lecture, 8:15 P.M., Opera House, Kiel Auditorium.

F2 *Society of Systematic Zoology*: Biologists' Smoker, 9:00 P.M. till 12:00 midnight, Exhibition Hall, Kiel Auditorium.

Mathematics

A, A1, A2, A3 *Section on Mathematics* and *Mathematical Societies*—6:30 P.M., Mathematicians' Dinner, Hotel Gatesworth.

Physics

B, B4 *Section on Physics* and *Sigma Pi Sigma*—7:00 P.M., Physicists' Dinner and Vice-Presidential Address of Section B, Crystal Room, Jefferson.

Chemistry

C, X2 *Section on Chemistry* and *Academy of Science of St. Louis*—7:00 P.M., Chemists' Dinner and Vice-Presidential Address of Section C, St. Louis Room, Statler.

Astronomy

D *Section on Astronomy*—8:00 P.M., Vice-Presidential Address of Section D, Private Dining Room 1, Jefferson.

Geology and Geography

E, E1 *Section on Geology and Geography* and *Geological Society of America*—8:00 P.M., Geologists' Smoker and Vice-Presidential Address of Section E, Wilson Hall, Washington University.

Botanical Sciences

G *Section on Botanical Sciences*—6:00 P.M., Bota-

nists' Dinner and Vice-Presidential Address of Section G, Ballroom Assembly South, Statler.

Psychology

I *Section on Psychology*—8:00 P.M., Symposium: Problems in Psychotherapy, Missouri Room, Statler.

Social and Economic Sciences

K, H *Section on Social and Economic Sciences* and *Section on Anthropology*—8:00 P.M., Symposium: Social and Economic Aspects of Technical Assistance Programs, Part III, Room B, Kiel Auditorium.

Medical Sciences

Nm, M, P, P1 *Subsection on Medicine, Section on Engineering, Section on Industrial Science,* and *American Industrial Hygiene Association*—8:00 P.M., Symposium: Health Hazards and Health Protection, Part II: Air Pollution, Assembly Hall 3, Kiel Auditorium.

Education

FG4 *National Association of Biology Teachers*—8:00 P.M., Meeting of Membership Committee, Parlor A, De Soto.

X4 *American Nature Study Society*—8:00 P.M., Annual Meeting of the ANSS, Cotillion Room, De Soto; 8:30 P.M., Annual Showing of Kodachromes, Cotillion Room, De Soto.

Science in General

X7 *National Association of Science Writers*—8:30 P.M., Symposium: Science in the News Columns, Private Dining Room 9, Jefferson.

Tuesday, December 30

Tuesday Morning

AAAS as a Whole

AAAS Council Meeting II—9:00 A.M., Private Dining Room 1, Jefferson.

AAAS General Symposium—The Nation's Nutrition: From Soil to Cytoplasm, Part I: Sources of Food, 9:30 A.M., Assembly Hall 1, Kiel Auditorium.

Mathematics

A3 *Mathematical Association of America*—9:00 A.M., Papers, Louderman Auditorium, Washington University.

Physics

B *Section on Physics*—9:00 A.M., Symposium: Magnetic Resonance and Its Applications, Room 3B, Kiel Auditorium.

B, B3, X3 *Section on Physics; Saint Louis University Institute of Technology, Department of Geophysics and Geophysical Engineering*; and *American Geophysical Union*—9:00 A.M., Invited Papers in Geophysics, Room B, Kiel Auditorium.

Chemistry

C *Section on Chemistry*—9:00 A.M., Concurrent Session 1, Symposium: Liquid Fuel Supplies of the Future and the Impact on the Chemical Industry by Chemicals Available as Coproducts from Synthetic Fuel Processes, Part I, Room 4C, Kiel Auditorium; 8:45 A.M., Concurrent Session 2, Symposium: Contributions of Chemistry to Agriculture, Part I, Room 4B, Kiel Auditorium.

Geology and Geography

E, E1 *Section on Geology and Geography* and *Geological Society of America*—9:00 A.M., General Geology: Stratigraphy and Sedimentology, Room 3A, Kiel Auditorium.

Zoological Sciences

F *Section on Zoological Sciences*—10:00 A.M., Concurrent Session 1, Papers: General Biology and Behavior, Parlor A, Statler; Concurrent Session 2, Papers: Embryology and Anatomy, Room 102, Statler.

F2 *Society of Systematic Zoology*—10:00 A.M., Papers: Nomenclature and Distribution, Ballroom Assembly South, Statler.

Botanical Sciences

G, FG2 *Section on Botanical Sciences* and *Ecological Society of America*—9:30 A.M., Symposium: Plant Sociology and the Taxonomy of Vegetational Units, Part I, Room 3C, Kiel Auditorium.

Psychology

I *Section on Psychology*—9:00 A.M., Papers: Theoretical Psychology, Private Dining Room 9, Jefferson.

Social and Economic Sciences

K, E, H, O *Section on Social and Economic Sciences, Section on Geology and Geography, Section on Anthropology,* and *Section on Agriculture*—10:00 A.M., Regional Research: Emerging Concepts and Techniques, Private Dining Room 3, Jefferson.

History and Philosophy of Science

L, L1 *Section on History and Philosophy of Science* and *Philosophy of Science Association*—9:30 A.M., Symposium: Philosophical Problems of Contemporary Biology, Room 4D, Kiel Auditorium.

Engineering

M, Nm, Nd, M2 *Section on Engineering, Subsection on Medicine, Subsection on Dentistry,* and *Central Institute for the Deaf*—9:30 A.M., Symposium: Hearing and Speech Aids, Part I, Clinics and Research Building, Central Institute for the Deaf.

Medical Sciences

Nm, M, P, P1 *Subsection on Medicine, Section on Engineering, Section on Industrial Science,* and *American Industrial Hygiene Association*—10:00 A.M., Symposium: Health Hazards and Health Protection, Part III: Radiation Hazards, Assembly Hall 3, Kiel Auditorium.

Np, N6, N8, N9, N12 *Subsection on Pharmacy; American Association of Colleges of Pharmacy; American College of Apothecaries; American Pharmaceutical Association, Scientific Section*; and *American Society of Hospital Pharmacists*—9:00 A.M., Papers, Room 3D, Kiel Auditorium; 10:15 A.M., Symposium: The Content of Hospital Pharmacy Courses in Schools of Pharmacy, Room 3D, Kiel Auditorium.

Industrial Science

I, M, P *Section on Psychology, Section on Engineering,* and *Section on Industrial Science*—9:30 A.M., Effective Utilization of Industrial Manpower, Part I: How Scientific is Modern Industry? Ivory Room, Jefferson.

Education

FG4, Q4, X4 *National Association of Biology Teachers, National Science Teachers Association,* and *American Nature Study Society*—8:00 A.M., Meeting of Officers to plan the 1953 coordinated program, Parlor D, De Soto; 8:30 A.M., Science Teaching Films, De Soto Room, De Soto; 10:00 A.M., Symposium: Producing and Using Science Text and Reference Books, De Soto Room, De Soto.

Q *Section on Education*—9:00 A.M., Papers, Private Dining Room 2, Jefferson.

Q, Q2 *Section on Education* and *American Educational Research Association*—9:30 A.M., Joint session, Private Dining Room 8, Jefferson.

Tuesday Noon and Afternoon

AAAS as a Whole

AAAS Section Officers Luncheon and Business Meeting—12:00 noon, Private Dining Room 4, Jefferson.

AAAS General Symposium—The Nation's Nutrition: From Soil to Cytoplasm, Part II: Assimilation of Food, 2:00 P.M., Assembly Hall 1, Kiel Auditorium.

Mathematics

A3 *Mathematical Association of America*—2:00 P.M., Business Meeting and Symposium: Teaching of Service Courses in Mathematics, Louderman Auditorium, Washington University; 3:30 to 5:30 P.M., Tea, Lounge, Women's Building, Washington University.

Physics

B, B1, B3, X3 *Section on Physics; American Meteorological Society; Saint Louis University Institute of Technology, Department of Geophysics and Geophysical Engineering*; and *American Geophysical Union*—2:00 P.M., Symposium: Tornadoes and Tornado Forecasting, Room B, Kiel Auditorium.

Chemistry

C1 *Alpha Chi Sigma*—12:30 P.M., Luncheon of St. Louis Professional Chapter, Private Dining Room 7, Jefferson.

C *Section on Chemistry*—2:00 P.M., Concurrent Session 1, Symposium: Liquid Fuel Supplies of the Future and the Impact on the Chemical Industry by Chemicals Available as Coproducts from Synthetic Fuel Processes, Part II, Room 4C, Kiel Auditorium; Concurrent Session 2, Symposium: Contributions of Chemistry to Agriculture, Part II, Room 4B, Kiel Auditorium.

Geology and Geography

E, E1 *Section on Geology and Geography* and *Geological Society of America*—2:00 P.M., Concurrent Session 1, General Geology: Pleistocene and Physical Geology, Room 3A, Kiel Auditorium; 2:00 P.M., Concurrent Session 2, Panel: Impact of the Missouri Basin Program, Room 3B, Kiel Auditorium.

Zoological Sciences

F, F2 *Section on Zoological Sciences* and *Society of Systematic Zoology*—2:00 P.M., Public Book Discussion Panel: Three College Zoology Texts, Ballroom, Statler.

F1 *Herpetologists League*—2:00 P.M., Conference on Common Names of Reptiles and Amphibians of the United States, Ballroom Assembly South, Statler.

Botanical Sciences

G, FG2 *Section on Botanical Sciences* and *Ecological Society of America*—2:00 P.M., Symposium: Plant Sociology and the Taxonomy of Vegetational Units, Part II, Room 3C, Kiel Auditorium.

Psychology

I *Section on Psychology*—1:00 P.M., Papers: Experimental Psychology, Private Dining Room 1, Jefferson.

I, Q *Section on Psychology* and *Section on Education*—2:00 P.M., Vice-Presidential Addresses of Sections I and Q, Private Dining Room 1, Jefferson.

Social and Economic Sciences

K *Section on Social and Economic Sciences*—2:00 P.M., Symposium: The Individual Scientist in Today's World, Private Dining Room 9, Jefferson.

History and Philosophy of Science

L1 *Philosophy of Science Association*—4:30 P.M., Business Meeting, Room 4D, Kiel Auditorium.

L, L1 *Section on History and Philosophy of Science* and *Philosophy of Science Association*—2:00 P.M., Symposium: Confirmation of Scientific Theories, Room 4D, Kiel Auditorium.

Engineering

M, Nm, Nd, M2 *Section on Engineering, Subsection on Medicine, Subsection on Dentistry*, and *Central Institute for the Deaf*—2:00 P.M., Symposium: Hearing and Speech Aids, Part II, Clinics and Research Building, Central Institute for the Deaf.

Medical Sciences

Np, N6, N8, N9, N12 *Subsection on Pharmacy; American Association of Colleges of Pharmacy; American College of Apothecaries; American Pharmaceutical Association, Scientific Section*; and *American Society of Hospital Pharmacists*—1:45 P.M., Papers, Room 3D, Kiel Auditorium; 2:30 P.M., Symposium: The Role of the U. S. P., the N. F., the N. N. R., and the A. D. R. in Developing and Maintaining Sound Drug Therapy Trends and Standards, Room 3D, Kiel Auditorium.

Industrial Science

I, M, P, M1 *Section on Psychology, Section on Engineering, Section on Industrial Science*, and *Association of American Railroads*—12:30 P.M., Luncheon Meeting and Address, Crystal Room, Jefferson.

I, M, P *Section on Psychology, Section on Engineering*, and *Section on Industrial Science*—2:30 P.M., Effective Utilization of Industrial Manpower, Part II: Contributions of the Several Disciplines, Ivory Room, Jefferson.

Education

FG4 *National Association of Biology Teachers*—2:00 P.M., Panel: Effective Techniques in Teaching Conservation in Biology, Parlor D, De Soto.

Q, I *Section on Education* and *Section on Psychology*—2:00 P.M., Vice-Presidential Addresses of Sections Q and I, Private Dining Room 1, Jefferson.

Q *Section on Education*—3:30 P.M., Business Meeting, Private Dining Room 1, Jefferson.

Q4 *National Science Teachers Association*—12:00 noon, Luncheon of the Business-Industry Section, Garden Room, Lennox; 2:00 P.M., Concurrent Session 1, Here's How I Do It—Senior High School Sciences, De Soto Room, De Soto; Concurrent Session 2, Here's How I Do It—Junior High School and Elementary Science, Hunt Room, De Soto.

X4 *American Nature Study Society*—2:00 P.M., Panel Discussion and Demonstration: Getting Better Results from Nature Photography, Cotillion Room, De Soto.

Tuesday Evening

AAAS as a Whole

X8 *Scientific Research Society of America*: Annual Address, 8:00 P.M., Gold Room, Jefferson.

Zoological Sciences

F, F2 *Section on Zoological Sciences* and *Society of Systematic Zoology*—7:00 P.M., Zoologists' Dinner and Vice-Presidential Address of Section F, Bevo Mill.

Education

FG4 *National Association of Biology Teachers*—8:00 P.M., Meeting of National Conservation Committee, Parlor D, De Soto.

Wednesday, December 31

Wednesday Morning

Physics

B1 *American Meteorological Society*—9:00 A.M., Conference of Midwestern Meteorologists, Private Dining Room 1, Jefferson.

History and Philosophy of Science

L *Section on History and Philosophy of Science*—9:30 A.M., Papers, Crystal Room, Jefferson; 11:00 A.M., Vice-Presidential Address of Section L, Crystal Room, Jefferson.

Education

FG4 *National Association of Biology Teachers*—9:00 A.M., Conservation Work Conference, Parlor D, De Soto.

Q *Section on Education*—9:00 A.M., Current Criticisms of Public Education and How to Meet them, Private Dining Room 8, Jefferson.

ANNUAL EXPOSITION OF SCIENCE AND INDUSTRY

The AAAS Annual Exposition of Science and Industry, which dates back to 1924 (still earlier with certain pioneer exhibitors), has become an important and integral part of the Association's annual meeting. It provides an outstanding opportunity for those who use the tools and materials of science to meet those who produce and distribute them. The 1952 edition of the Exposition, which occupies the Convention Hall of the Kiel Municipal Auditorium, is up to the same high standard of previous years.

The exhibits include the latest and best in scientific books, instruments, and materials; they are on a scale, and with a diversity, not usually possible at the meeting of an individual society or group of societies in a single field of science. In addition to this "core" of the Exposition, a variety of organizations have special exhibits, and there are technical exhibits by large firms representative of the basic industries of the nation. Prominent concerns in the chemical, pharmaceutical, and other industries are sharing with the attending scientists some of their impressive technological accomplishments. The Exposition should not be missed by anyone who attends the meeting. Your Convention Badge assures admission.

The AAAS Annual Exposition of Science and Industry fills Convention Hall of the Kiel Municipal Auditorium. The exhibit area, which is on the second floor, is reached through the 14th Street Entrance.

The Exposition is open to:

1. All registrants attending the 119th meeting.
2. Interested **adults** who have applied for, and received, complimentary tickets of admission.

Hours

Saturday, Dec. 27	10:00 A.M.–6:00 P.M.
Sunday, Dec. 28	Noon–6:00 P.M.
Monday, Dec. 29	11:00 A.M.–9:00 P.M.
Tuesday, Dec. 30	10:00 A.M.–4:00 P.M.

Directory of Exhibitors

(*Descriptive material prepared by individual exhibitors*)

AAAS New Member Service—Science—The Scientific Monthly (Booth 93). There are personal advantages in joining the Association. Every person in attendance at the 119th meeting is cordially invited to visit the New Member Service for information concerning the Association. Since its founding, in 1848, the Association has admitted to membership not only professional scientists but also other men and women who have a general interest in science, who wish to keep informed of the progress of science, and who would like to support the high purposes of the one organization that represents *all* science.

Included in the annual dues of $6.50 (for 1953), each member has a choice of a year of SCIENCE, the professional scientist's newsweekly, or THE SCIENTIFIC MONTHLY (or *both*, for an additional $3.50). Free sample copies of these two publications will be distributed, and all not familiar with both magazines are invited to visit this booth. The Symposium Volumes and other publications of the AAAS are also on display. *Prospective advertisers* may obtain sample copies of the magazines and rate cards. Members of the AAAS are requested to nominate fellow scientists for membership.

Leland B. Alford, M.D., St. Louis, Missouri (Booth 65). The localization of dementia ("confusion") in the human brain. This relatively novel finding is now supported by a number of independent studies. Associated with certain lesions in the region of the thalamus, in themselves not particularly nocuous, is the symptom or group of related symptoms variously designated as dementia, confusion of consciousness, disorientation, and unconsciousness. In no other part of the brain is this clinical picture produced. Since in this condition practically all rational psychological responses are abolished, the theoretical implications appear to be highly important. The exhibit shows photographs and drawings of erebral lesions in which dementia was the symptom and of control lesions in various locations where mental capacity was excellent. The cases are from both the exhibitor's own material and from medical literature.

Aloe Scientific (Booths 69 and 70). The Aloe Scientific exhibit consists of new and modern laboratory devices for research and teaching purposes. The De Fonbrune Micromanipulator and Microforge will be demonstrated. Aloe Moduline steel laboratory and institutional furniture will be displayed.

American Cancer Society, Inc. (Booths 77 and 78). Statistical data on incidence and mortality, section on demographic and possible etiologic aspects; staging of disease, with emphasis on Stage 0 and its diagnosis. Diagnostic methods, with particular emphasis on the role of cytology in detecting early cervical cancer, methods of taking a cervical biopsy. The problem of cancer of the cervical stump is outlined; results of treatment of the four stages of cervical cancer are indicated.

The American National Red Cross (Booths 54 and 55). The Red Cross exhibit will illustrate a large cut-out map of the United States dramatically backlighted and showing, by means of applied cut-outs, the distribution of blood centers and blood banks. The travel route of the blood trains will also be indicated. This section will contain a small animated unit on the filling of the blood bottle. On each side of the booth we will present recipient set and other equipment in two assembled displays.

American Optical Company (Booth 87). Among the group of instruments the American Optical Company's Instrument Division will display will be a phase microscope. The relatively new field of phase microscopy has proved essential for the examination of living organisms and tissues, slightly pigmented or faded preparations, emulsions, plastics, and other material too transparent to be seen with bright-field microscopy. The new simplified P45 Polarizing Microscope, a low-priced instrument designed for crystallography, chemical microscopy, and petrography, both for educational and industrial use, will also be an interesting highlight of the AO exhibit. Also to be displayed is an AO Spencer Photomicrographic Camera with convenient, yet rapid, operational features, designed for use with a monocular microscope. Representatives of the company, C. M. Osborne and P. R. Beckett, will be on hand to demonstrate and discuss the many improvements and outstanding advantages of AO instruments.

American Pharmaceutical Association (Booths 63 and 64). The exhibit of the American Pharmaceutical Association shows the role of the pharmacist as a member of the public health team. It also emphasizes the services of the American Pharmaceutical Association over the past century, since this is its centennial year. Photographs showing the association's headquarters in Washington are included in the exhibit.

The American Tobacco Company (Booths 73 and 74).

The exhibit of the Research Laboratory of The American Tobacco Company will feature a new type of moisture meter which has been developed by its Instrument Division. This meter records moisture content of tobacco directly by automatically correcting for temperature and eliminates errors previously encountered in manually operated instruments. This is another example of original application of well-known principles which result in closer control of quality in *Lucky Strike* cigarettes.

Animal Welfare Institute (Booth 43). Established in 1951 as a nonprofit educational and research organization in the field of laboratory animals including their care, housing, and procurement, the Animal Welfare Institute has three immediate aims in its work toward a more complete understanding between science and humanitarianism: (1) The encouragement of medical research techniques of the highest quality, to reduce both the pain and number of animals required in the laboratory; (2) to discover the most suitable methods of procurement of laboratory animals without jeopardizing constructive humane work; (3) the establishment of a standard code of ethics for the use of laboratory animals. The institute provides a forum and clearinghouse for the legitimate claims of scientists and humanitarians alike, and has made considerable progress in this field since last year's Exposition in Philadelphia. President of the organization is Christine Stevens; headquarters is 730 Fifth Ave., New York 19.

Arel Inc. (Booth 6). Arel will show the Medatron medical dental camera unit. Designed in conjunction with outstanding physicians and dentists in Portland, Ore., and at the University of Oregon Medical School, this unit is the answer for the doctor or dentist who desires to use photography in his practice for clinical records, progress recording of cases, and lecture purposes. Compact and portable, total size $7'' \times 7'' \times 8''$, this unit contains its own light source, calibrated for use with daylight-type color film. It is instantly ready for use and is so designed that it automatically computes the exposure, so that a nurse or technician completely unacquainted with photography can obtain the same results as the photographic expert.

Armour and Company (Booth 68). In keeping with its policy of Serving Science, Industry, and Medicine, the Central Research Department, Research Division of Armour and Company, will present the following specialty items for experimental use: Pure normal C_{12} and C_{18} acids, methyl esters, and amines; purified hormones and enzymes of animal origin; liver and plasma fractions; animal lipids, reference compounds, and other fine chemicals. A research investigator will answer your questions concerning the chemical, physical, and biologic properties of such compounds.

Association of American Railroads (Booths 91 and 92).

Association of American University Presses (Booth 26). Examine these new University Press books—and others—at Booth 26: Trumpler and Weaver *Statistical Astronomy*, $7.50 (California); Milne *Sir James Jeans*, $4.00 (Cambridge); Conant *Modern Science and Modern Man*, $2.00 (t) (Columbia); Sarton *A History of Science: Ancient Science Through the Golden Age of Greece*, $10.00 (Harvard); Linsky, editor, *Semantics and the Philosophy of Language*, $3.75 (Illinois); Gowen, editor, *Heterosis*, $5.75 (Iowa State); McElroy and Glass, editors, *Phosphorus Metabolism*, Volume II, $10.00 (Johns Hopkins); Dice *Natural Communities*, $5.50 (Michigan); Albaum et al. *Biology of Phosphorus*, $2.00 (Michigan State); Storck and Teague *Flour for Man's Bread*, $7.50 (Minnesota); Leverton *Food Becomes You*, $3.50 (Nebraska); White and Benson, editors, *Physics and Medicine of the Upper Atmosphere*, $10.00 (New Mexico); Russell et al. *Time and its Mysteries*, $3.00 (New York); Møller *The Theory of Relativity*, $7.00 (Oxford); Fogg, editor, *The Scientists Look at our World*, $3.00 (Pennsylvania); Sanford et al. *Psychology in the World Emergency*, $4.00 (Pittsburgh); Winslow *Man and Epidemics*, $4.00 (Princeton); Hilgard et al. *Psychoanalysis as Science*, $4.25 (Stanford); Hartman *Possums*, $6.00 (Texas); Buller *Researches on Fungi*, Volume VII; *The Sexual Process in the Uredinales*, $13.50 (Toronto); *Marine Fouling and its Prevention*, $10.00 (U. S. Naval Institute); Robinson *The Look of Maps: An Examination of Cartographic Design*, $2.75 (Wisconsin); Urey *The Planets: Their Origin and Development*, $5.00 (Yale).

Bausch & Lomb Optical Co. (Booth 100). There are many items of interest to be seen in the Bausch & Lomb exhibit. Besides the line of dynoptic microscopes, stereomicroscopes, phase contrast microscopes, and grating monochromator, two brand-new items will be shown. An eyepiece camera designed to fit any standard microscope will take pictures on 35mm and $2\frac{1}{4} \times 3\frac{1}{4}$ film, either colored or black-and-white. The viewing device is unique by virtue of this long eye relief and the fact that it need not be removed during the exposure, which makes it nicely suited to live material. Another brand-new item is the monochromatic colorimeter. The new model offers greater accuracy and convenience than ever before. Special interference filters used with the instrument have a band pass of 20 mμ which is far narrower than glass filters and those used on many higher-priced spectrophotometers. Easier and faster analysis is possible by redesign of the controls. Although intended primarily for routine clinical and industrial analyses, it can be used for research because of its accuracy and sensitivity. B&L representatives will welcome inquiries.

The Bioscope Manufacturing Company (Booth 13). Modernize your microscopic study with a Bioscope. This instrument will project microscopic slides down on a table or on a wall screen. Especially made to project living material without harmful heat. The Bioscope makes microscopic study thrilling and interesting to students; speeds up microscopic study tremendously; eliminates eye strain and cramped positions; and makes a great saving in microscopes and slides. Be satisfied only with the genuine and original Bioscope. Do not be misled by imitations and higher prices. We are the oldest company specializing in the microprojection field. If there were a better way to do the job *we* would know about it and *do* it. We have pioneered in this field since 1934. More than 25,000 school people have approved the purchase of the Bioscope for their school. This great volume of sales and our know-how enable us to offer the best buy on the market. See it demonstrated at our booth. Master Model Bioscope with Polarizer—$98.50; high power attachment —$17.50. Standard Model (without attachments)—$87.50. Especially selected slides (25 per set)—$9.50.

The Blakiston Company (Booth 4). The Blakiston Company cordially invites all members of the AAAS to its exhibit of scientific textbooks and reference works. There will be a number of outstanding new books awaiting your examination. Don't miss *Comparative Vertebrate Embryology* by Nelson—the best book in its field! Ask to see the brand-new *Paramecium* by Wichterman—the most extensive coverage ever made of a microscopic animal. Be sure to look over *Factors of Evolution* by Schmalhausen—supplies important link in the modern view of evolution. Other new books that will be here for your consideration are: *Sheep Management and Diseases* by Belschner; *Physics for Science and Engineering Students* by Furry, Street, and Purcell; *Introductory General Chemistry* by Cavelti; *Quantitative Organic Microanalysis* by Steyermark; *Deciduous Forests of North America* by Braun; *Bacteria* by Thomas and Grainger; *Insect Natural History* by Imms; and *Handbook of Basic Microtechnique* by Gray. Jim Lackey, our science editor, and members of our educational staff will be on hand to discuss these and other distinguished Blakiston works.

Carolina Biological Supply Company (Booth 75). The Carolina Biological Supply Company, of Elon College, North Carolina, and Waubun Laboratories, of Schriever,

Louisiana, will exhibit a complete range of biological materials and some pathological materials embedded in plastic. Among the products displayed will be preserved and injected macroscopic specimens, living cultures, bacteriological material, botanical specimens, prepared microscopic slides, and kodachromes for botany and zoology. One of the focal points of interest will be the famous Plast-O-Mounts. There will be in attendance a professional to explain Carolina technique in plastic embedding and color preservation. A general cross section of standard brands laboratory apparatus will be exhibited, including microprojectors and microscopes. A staff of professional biologists will be in charge of the booth and will offer complete biological material information. Free literature, including teaching aids, will be available to visitors at our booth.

The Chemstrand Corporation (Booths 15, 16, and 17). The Chemstrand Corporation exhibit dramatizes the functional and fashion characteristics of the firm's new acrylic fiber Acrilan, which had its world premiere showing in New York City last fall. Merchandise of Acrilan was introduced to consumers simultaneously in the leading markets of the country. The exhibit marks a year of progress since the company's first participation in the AAAS at Philadelphia in 1951. The emphasis then was on the research and development progress of the fiber, which at that time was in pilot plant production only. Using display and show props from the company's debut performance, this year's exhibit features not only the fiber Acrilan and its properties and characteristics, but also the fashion aspects of the fiber translated in terms of fabrics and styles made wholly of Acrilan or of Acrilan in blends with other commercially available fibers. The center theme of the exhibit features a wire-mesh mannequin 12 feet 6 inches in height and stuffed with Acrilan fiber. Draped over the body and arms of the "lady" are 40 yards of challis fabric made of 100% Acrilan. Flanking this "theme" display are four spot displays, each dramatizing a functional characteristic of the fiber. One illustrates "washability," showing blanketing material of 100% Acrilan, which is shrinkage-free and without color loss after repeated washings; a second display features "mothproofness" of a fiber; a third, the "hand and feel" of the fiber when translated into fabrics; and the fourth, the "quick-drying" aspects of Acrilan, which is hydrophobic. Mannequins are used against colorful backdrops to highlight around-the-clock and around-the-season styles of Acrilan, ranging from sport and casual wear to formal attire, and deep-pile fabrics for stoles and capes. The Chemstrand Corporation, an associate company jointly owned by Monsanto Chemical Company and American Viscose Corporation, this year brought its new Acrilan manufacturing facilities into commercial operation at Decatur, Ala. The plant will have an initial capacity of 30,000,000 pounds of staple annually when brought to peak operation. The company also has its four-unit research and development center and corporation administrative headquarters at Decatur. A 50,000,000 pound per year Chemstrand nylon filament yarn plant is under construction near Pensacola, Fla., the first wholly integrated nylon plant to be built in this country.

The Coca-Cola Company (Booths 18 and 19). Ice-cold Coca-Cola served through the courtesy and cooperation of the Coca-Cola Bottling Company of St. Louis and The Coca-Cola Company.

Department of Anatomy, Duke University School of Medicine, J. E. Markee and R. F. Becker (Booth 46). The exhibit on the autonomic nervous system consists of twenty 8" x 10" transparencies which illustrate the key scenes in the motion picture on the autonomic nervous system. The autonomic nervous system innervates smooth muscle, cardiac muscle, and glands. It is a visceral motor system in contrast to the voluntary motor system, which innervates only skeletal muscle. These transparencies illustrate the two main divisions of the autonomic nervous system—namely, the parasympathetic and sympathetic, and include the origin and distribution of these two divisions. They illustrate the connections of the spinal nerves with sympathetic trunk and chain ganglia by white and gray rami, and show the segmental connections of spinal cord with sympathetic trunks. The innervation of the gut by parasympathetic and sympathetic fibers, the plexuses of Auerbach and Meissner, and the components of the viscero-visceral reflex are are illustrated. Whereas a single motor fiber is required for the innervation of voluntary muscle, two neurons are always involved in viscero-motor innervation. Certain peripheral structures, such as sweat glands, pilomotor muscles, and arterioles, are innervated only by the sympathetic division. The final two transparencies illustrate the cholinergic and adrenergic classification of motor fibers.

Department of Anatomy, Saint Louis University School of Medicine, Albert Kuntz (Booth 66). The exhibit on the autonomic nervous system will consist of illustrations based on research carried out in the Department of Anatomy, Saint Louis University School of Medicine: (1) Drawings and photographs from dissections of the human body to illustrate the anatomical relationships of the sympathetic trunk, communicating rami and interconnecting rami, and accessory sympathetic ganglia. (2) Drawings based on detailed dissections and microscopic preparations of the vertebral nerves and the perivascular plexuses on the vertebral and the basilar arteries in the cat. (3) Diagrammatic illustration of the reflex arcs that mediate visceral vasomotor responses to localized thermal stimulation of the skin. (4) Photomicrographs illustrating the cytological structure of autonomic ganglion cells, with particular reference to chromidial substance, Golgi's apparatus, and ascorbic acid. (5) Photomicrographs illustrating: (*a*) Histochemical alterations in autonomic ganglion cells associated with aging. (*b*) Accumulation of pigment and excessive growth of dendrites in human autonomic ganglion cells in advanced age. (6) Photomicrographs from sections of autonomic ganglia showing neuroglial cells undergoing amitotic division, and lysis of ganglion cells by cells derived from ganglion cell capsules. (7) Photomicrographs illustrating histochemical alterations in autonomic ganglion cells in scorbutic guinea pigs.

Department of Pathology and Research, Saint Louis University School of Dentistry, W. H. Bauer (Booth 67). A display of the diseases of the human salivary gland.

Gilson Medical Electronics (Booth 20). GME, Madison, Wis., will feature the GME spiral fraction collector. Only the test-tube table moves, turning and advancing under the stationary column. The apparatus may be time-operated, or a volumetrically activated mechanism may be used. Another new instrument will be a compact circular shaker, 17" in diameter, which accommodates at one time a 1- or 2-liter Erlenmeyer flask and six 500-cc or smaller Erlenmeyer flasks. The shaking action is continuously variable in speed, and provides mixing without excessive aeration. Also to be shown is the GME-Lardy circular Warburg Model 2 incorporating sundry improvements; and Model B of the GME 8 channel EEG and polygraph for recording pressure, temperature, muscle potentials for kinesiology, psycho-galvanic reflex, movement, and other physiological variables. It is entirely line-operated and is extremely stable even with large line voltage fluctuations. The frequency response is flat to 100 cps. The apparatus is only 19" square, an important factor in a crowded laboratory.

Gradwohl Laboratory Supply Company (Booths 79 and 80). This exhibit will show the various activities of the Gradwohl Laboratory Supply Company—namely, manufacture and supply of laboratory reagents, the training of laboratory technicians, the publication of a monthly journal entitled the *Laboratory Digest* which gives recent advances in laboratory procedures (the next,

the emphasis on the Papanicolaou method of cancer detection).

The Graf-Apsco Company (Booth 7). The newly designed Graf-Apsco microscopes are displayed for examination and use. As "America's Leading Microscope Repair House" the aim in designing these instruments was to make them as foolproof as possible. You will be pleasantly surprised to find the usual points of irritation missing—and prices unbelievably reasonable. In addition to new microscopes, we also display a wide assortment of rebuilt instruments. All our instruments, whether new or rebuilt, carry a ten-year guarantee against defective parts and workmanship. If you have any repair or obsolescence problems, bring them to us. We shall be glad to help, regardless of the make of instruments.

Harvard Apparatus Company, Incorporated (Booth 42). In 1888 William Townsend Porter, a young professor in the St. Louis Medical College, established the first physiological laboratory west of the Great Lakes. Later, at Harvard, he supplied from the small machine shop of Professor Bowditch's pioneer laboratory the first inexpensive but well-made instruments for the student of physiology, there and elsewhere. He thus implemented his own enthusiastic development of the new laboratory teaching. This epochal service of the "Harvard Physiological Apparatus," generally socalled fifty years ago, was soon on its own and became as a nonprofit enterprise the organization incorporated in 1934, with full recognition of a long-maintained annual research grant, now the Porter Fellowship. For the first time in the half-century of its history, the company is undertaking (as a tribute to the St. Louis birthplace of its founder's professional career) the exhibition of its entire product. The range of this showing, from the new to the old, is fairly wide. It runs from recent developments in the kymograph, respirator, stand, etc. to the numerous simple accessories long in constant demand by biological departments of schools and colleges, as well as by medical schools and institutes of research.

Houghton Mifflin Company (Booth 5). Houghton Mifflin Company will exhibit its extensive list of college texts in the fields of Biology, Chemistry, Economics, Mathematics, Physics, Sociology, Psychology, and General Science. Included with these college texts will be several trade books of general interest to science teachers.

International Auxiliary Language Association (Booth 61). The International Auxiliary Language Association wishes to bring to the attention of AAAS members attending the annual meeting information about our research and the form of international communication resulting from it—namely, Interlingua. Scientists are showing considerable interest in Interlingua as a potential tool in the exchange of information at the international level.

International Shoe Company (Booth 71). International Shoe Company exhibit will have as its objective an exposition of the degree to which vertical organization or integration has been developed in the company's operations. The exhibit will illustrate the extent to which the company starts its manufacture with basic raw materials, such as hides, rubber, cotton, and other natural and synthetic raw materials, and converts these for final distribution at the consumer level.

Josiah Macy, Jr. Foundation Publications (Booth 45). You are cordially invited to visit the display of the Transactions of the Conferences sponsored by the Josiah Macy, Jr. Foundation. This year we are presenting the transactions of two new conferences; Cold Injury and Shock and Circulatory Homeostasis, which should be of interest to those concerned with the current medical problems of the Armed Forces. Also available for your examination are our latest publications on Adrenal Cortex, Aging, Biological Antioxidants, Blood Clotting, Blood Pressure, Clinical Psychology, Connective Tissues, Consciousness, Cybernetics, Infancy and Childhood, Liver Injury, Convalescence, Metabolic Interrelations, Nerve Impulse, Renal Function. Elizabeth Fuller and Alfred Patten will be on hand to answer questions and to explain this new approach in medical literature. These books are verbatim reports of meetings in which representatives from all professions and specialties relevant to the topic participated. The material published is unobtainable elsewhere and is the most advanced information available to investigators and practicing physicians concerning research progress and new methods and theories. The transactions offer, as well, interesting insight into the broad problem of communication and integration between disciplines, a question of importance to the advancement of the whole of science. In order to make these books available to the greatest number of those interested the foundation offers them for sale at cost.

Mallinckrodt Institute of Radiology, Washington University School of Medicine (Booths 97, 98, and 99). The exhibit will feature diagnostic roentgenology with opaque contrast media. (Space endowed by the Mallinckrodt Chemical Works.)

G. & C. Merriam Company (Booth 60). The Exhibit will display copies of the Merriam-Webster publications listed below: *Webster's New International Dictionary*, Second Edition—the unabridged work containing 600,000 entries, including thousands of encyclopedic articles, many of them recording a wealth of information in the field of science. *Webster's New Collegiate Dictionary*—our largest abridged work, completely up to date—copyright 1951. *Webster's Dictionary of Synonyms*—listing Synonyms, Antonyms, and Analogous and Contrasted Words, explaining the difference in their shades of meaning and illustrating their use. *Webster's Biographical Dictionary*—entering 40,000 biographies of noted men and women of all countries, with name pronunciations. *Webster's Geographical Dictionary*—records information on all the world's important places, with name pronunciations. There will also be shown pamphlets illustrating and explaining the use of the above publications.

Midwest Rubber Reclaiming Company (Booth 62). The exhibit consists of diagrammatic flow sheets of the two major processes used in the East St. Louis plant of the company, starting with the raw material—i.e., scrap tires—and guiding the observer through the various stages of the processes to the final products obtained therefrom. Transparencies of factory equipment are built into the flow sheets to give a better understanding of the process and machinery involved. One of the side panels gives statistical data of production capacities and consumption of reclaim over several decades, as well as its position in relation to the total consumption of natural and synthetic rubber in the United States. Another side panel shows the consumption of reclaim as related to its use in consumer goods such as tires, battery cases, automotive and mechanical goods, etc.

Missouri Geological Survey (Booths 85 and 86). The exhibit has been designed to highlight the occurrence and distribution of mineral raw materials in Missouri. A panorama shows in cross section this occurrence and distribution. Mineral and rock samples of each material will be available for close examination by all visitors.

Monsanto Chemical Company (Booths 27, 28, 29, and 30). Monsanto will have a display of over 500 Monsanto products. Particular emphasis will be placed on the part research plays in our organization.

Philip Morris & Co. Ltd., Inc. (Booth 53). Physiologic and pharmacologic methods are used for the evaluation of the irritants in cigarette smoke.

The C. V. Mosby Company (Booth 52). The C. V. Mosby Company extends a most cordial invitation to visit Booth No. 52, where books designed for teaching and reference will be available for examination. New books and new editions to be displayed will include Beaver's *The Science of Biology* and *Biological Science in Laboratory and Field*, Zoethout and Tuttle's *Textbook of Physiology*, Lindsey's *Principles of Organic Evolution*, Krajian and Gradwohl's *Histopathological Technic*, Anderson's

Synopsis of Pathology, Harrison's *Dissection of the Cat*, Walling's *Laboratory Manual for Elementary Physiology*, and Schaub and Foley's *Diagnostic Bacteriology*. Our representatives will welcome an opportunity to discuss book needs.

National Bureau of Standards (Booths 35, 36, 37, 38, 39, and 40). The NBS exhibit will cover three areas: (1) Fundamental measurement of standards of science; (2) instrumentation; and (3) publications. The section on standards presents the following topics: Length, mass, optical, temperature, frequency and time, and electrical standards. The importance of instrumentation in science and industry is presented in panels and embraces mechanical electronics, atomic and radiation, aeronautic, optical, and textile fields. The publications unit illustrates a variety of research and development projects in the physical sciences carried at NBS.

National Cancer Institute, USPHS, W. C. Hueper (Booths 88 and 89). The environmental respiratory cancer: The exhibit shows the various recognized and suspected environmental agents implicated in the production of cancer of the respiratory organs, and the different physical-chemical states of contact, as well as their relation to the sites of the resulting cancer. Special graphs demonstrate the simultaneous rise of lung cancers, and of the production and consumption of industrial products for potential causal relations to cancer of the lung during the past 30 years. A map of the U. S. illustrates the distinct regional differences in lung and larynx cancer morbidity in eight metropolitan areas surveyed in 1938 and again in 1948, as well as the uniform rise in lung cancer morbidity in the eight areas during this decade.

National Geographic Society (Booths 83 and 84). The exhibit of the National Geographic Society will feature the *National Geographic Magazine* and the *Geographic School Bulletins*. Also on display will be maps, books, pictures, and other special educational materials of the society. An automatic projector will screen a continuous selection of natural color slides. The slides cover National Geographic field assignments and expeditions and were selected from illustrations by staff photographers of the *National Geographic Magazine*.

National Society for Medical Research (Booth 44). The exhibit of the National Society for Medical Research will endeavor to show the essential role animals play in the advancement of the biological sciences. Featured in the exhibit will be a number of animals that are actually being used in chronic studies. These will include dogs, rats, and guinea pigs. With the animals will be displayed some of the scientific equipment used in these same chronic experiments. An effort will be made to show that this costly equipment, valuable as it is, would be of no worth without animal subjects upon which to conduct the experimental studies. Also included in NSMR's exhibit will be a one-panel mounted board display, explaining the importance of backing the National Society for Medical Research. There will be someone in constant attendance at the exhibit, and a quantity of NSMR literature.

Naval Ordnance Laboratory (Booth 82). The Naval Ordnance Laboratory, the primary research and development activity of the Bureau of Ordnance, will feature a display on the processing of Bismanol, one of its newest developments. Bismanol is a magnetic material which exhibits a coercive force of 3000 oersteds, the highest recorded coercive force of any known permanent magnetic material. It has been named Bismanol from its composition of bismuth and manganese and NOL, where it was prepared. The Naval Ordnance Laboratory exhibit will also show in panel form some of its other major fields of research, its over-all mission, and the layout of its 873-acre tract at White Oak, Silver Spring, Md.

Naval Research Laboratory (Booth 81). "Crystals for Commerce" and "Crystals for Defense" will be featured in the exhibit of the Naval Research Laboratory of the Office of Naval Research. Crystal research, one of the research and development programs at NRL, has led to numerous discoveries that are useful in both peace and war. From crystal research has come hearing aids and gun sights, apparatus for locating fish and submarines, instruments for seeing at night, improved radio performance, picture tubes for television sets, light meters for photographers, instruments for measuring atomic radiations, equipment for testing the quality of gasoline, improvements in telephones, fluorescent lights, jewels for watches, and many more.

Nuclear Instrument & Chemical Corporation (Booth 76). The Nuclear Instrument & Chemical Corporation exhibit contains various electronic instruments for the detection and measurement of nuclear radiations. Scalers and count rate meters, together with portable monitoring instruments of interest to civil defense people, are on exhibit. Several new instruments of special interest to radioisotope laboratory personnel are on public display for the first time. Representatives of the company in attendance at the exhibit will be glad to assist anyone attending the meeting.

A. J. Nystrom & Co. (Booth 8). A. J. Nystrom & Co. is featuring an improved series of biological and anatomical models made of vinyl plastic, which have these unusual features:

1. Lifelike flexibility
2. No shrinkage or warping
3. Nonfading colors
4. Authentic anatomy
5. Unaffected by climate
6. Extraordinary durability

These unique qualities make our vinyl plastic models the finest specimens available from any source. Ask or write for an illustrated catalog. Among our fine chart publications we have the *Jurica Biology Charts*, *Frohse Life-sized Anatomical Charts*, and *Davis-Smith Science Charts*.

Philosophical Library (Booth 72). The Philosophical Library will feature the following new titles: *Harwell: The British Atomic Energy Research Establishment 1946–1951; The New Dictionary of American History; Dead Cities and Forgotten Tribes; The Hebrew Impact on Western Civilization; Ancient Sparta; The Tree of Human History; The Infirmities of Genius; The Story of Watches; Water; Little Ship Astro-Navigation; Fleas, Flukes and Cuckoos; The Organ;* and *The Development of the Guided Missile*.

Publishers' Authorized Binding Service (Booth 41). PABS, sponsored by many leading scientific societies and publishers of scientific and technical journals, both American and foreign, offers a service as modern as atomic energy. PABS is distinctively designed, durably crafted to rigid specifications, sensibly priced. PABS "facsimiled" bindings render competent service to men and women in science. PABS also conserves valuable space. Inspection of the product will demonstrate an effective, economical method of preserving journals for rapid reference and research.

The Rayoscope (Booth 1). At the Rayoscope booth will be shown what good microprojection practice can do for anyone ordinarily using a microscope. With especially developed optics an entirely new field has been opened. Specimens both living and prepared will be projected under extremely high power in the brightly lighted auditorium.

Saint Louis University School of Dentistry (Booth 90). The Saint Louis University School of Dentistry will have two exhibits, one on cleft palate cases, and the other on tumors of the jaw. *Cleft Palate Cases*: Many cleft palate cases showing conditions before surgery or prosthetic appliances were applied and also the same cases after treatment. These cases cover a wide age range. *Tumors of the Jaw*: This display shows a great variety of tumorlike growths and neoplasms occurring in the jaws. Roentgenograms and color microphotographs of

the so-called ossifying fibroma (preferably called ossifying fibrosis) and various types of ameloblastmas.

Schwarz Laboratories, Inc. (Booth 56). Schwarz Laboratories, Inc., of Mount Vernon, N. Y., are consulting chemists and engineers to the food and allied industries, and manufacturers of amino acids and other fine chemicals, chemotherapeutic agents, and radioactive biochemicals. Available at the exhibit of Schwarz products and services will be samples of such basic metabolites as yeast ribonucleic acids, nucleosides, nucleotides, phosphorylated carbohydrates and related materials, and recent additions to the Schwarz list—e.g., optically standardized amino acids, nitrogen heterocycles, etc. Schwarz representatives will be glad to explain the firm's products and services and to discuss individual requirements.

The Science Library (Booths 105, 106, and 107). The Science Library is administered by the AAAS as an additional service to publishers of books, both exhibitors and nonexhibitors. It has become an integral part of each year's Annual Exposition of Science and Industry. In the Science Library, books of all publishers participating are *grouped by fields of science*—a convenience both to the visitor who is restricting his inspection of books to a single category, and to the one who wishes to browse. Among the publishers represented in the Science Library are:

American Association for the Advancement of Science
Academic Press, Inc.
Addison-Wesley Press, Inc.
American Book Company
Annual Reviews, Inc.
Appleton-Century-Crofts, Inc.
Columbia University Press
Cranbrook Institute of Science
Thomas Y. Crowell Company
E. P. Dutton & Co., Inc.
Elsevier Press Inc.
Emerson Books, Inc.
Exposition Press Inc.
W. H. Freeman and Company
Harvard University Press
D. C. Heath & Company
Island Press Co-operative, Inc.
Lea & Febiger
J. B. Lippincott Company
McGraw-Hill Book Company
The Macmillan Company
Rand McNally & Company
Reinhold Publishing Corporation
Rinehart & Co., Inc.
W. B. Saunders Company
Silver Burdett Company
Stanford University Press
Charles C Thomas, Publisher
University of Kansas Press
University of Miami Press
University of Michigan Press
University of Minnesota Press
University of Pennsylvania Press
John Wiley & Sons, Inc.

Scott Aviation Corporation (Booth 9). Scott Aviation Corporation will display several industrial breathing devices, developed and sold since World War II to an imposing list of companies for production as well as laboratory service. This company since 1943 has been the largest producer of self-contained portable demand breathing apparatus, used for military and civilian purposes. Displayed will be the Scott Air-Pak, widely used to protect personnel in breathing hazards. Approved by the Bureau of Mines, it permits active work in hot or toxic atmospheres, often encountered throughout industry, including work relating to the atomic program. Its use of pure breathing air, not oxygen, assures the utmost in safety and comfort, even in atmospheres of petroleum vapors. It is designed to operate in extreme temperature conditions, as is illustrated by its long record of service with oil producers in the heat of Saudi Arabia and in the extreme cold of Alberta, Canada. Also displayed will be Scott oxygen inhalator equipment, accepted by the American Medical Association and used wherever oxygen administration is required.

Ivan Sorvall, Inc. (Booths 2 and 3). Ivan Sorvall, Inc., pioneers of the angle type centrifuges in the U. S., is located in the main exhibit hall just inside the registration and information center. The Servall exhibit features most models of the Servall angle centrifuges, as well as other special instruments for routine or research laboratory work. Shown in connection with the centrifuges are newly developed accessories, which further add to the convenience of working with the Servall angle centrifuges. For the first time the new Servall refrigerated centrifuge is proudly presented to the AAAS. On the market less than a year, it has already proved to be a most valuable instrument for many research projects in the medical and other scientific fields. Not less than seven different Servall centrifuge rotors, ranging from large capacity to high speeds, can be operated interchangeably in this unit without the need of costly adapter accessories. The 400cc Type SS-1 rotor, run for an hour at 14,000 rpm, will maintain material temperatures below 0° C. Convention participants are cordially invited to stop at the Servall exhibit to discuss centrifugation problems with the attendants, who will be happy to offer suggestions and advice.

Special Libraries Association, Greater St. Louis Chapter (Booth 108). The Greater St. Louis Chapter of the Special Libraries Association will exhibit a typical Technical Reference Library. Information on the activities of the chapter will be distributed.

The Technicon Company (Booths 49, 50, and 51).

U. S. Naval Dental School (Booth 33). The U. S. Naval Dental School's method for preparing auricular prosthesis. This exhibit depicts by means of Kodachrome transparencies and models the step-by-step procedures used in the preparation of auricular prosthesis by the Naval Dental School, U. S. Naval Medical Center, Bethesda, Md.

U. S. Naval Hospital, Yokosuka, Japan (Booth 32). Electroencephalography in combat head injuries. In February 1951 a Department of Neurology that included a Laboratory of Electroencephalography was established at the Naval Hospital in Yokosuka, Japan. From the outset, serial EEG tracings proved to be a valuable adjunct in the evaluation of acute head injuries. With the rapid changes seen in some, it was evident that the earlier the series could be started, the more meaningful they would be. The extension of these observations to the immediate combat zone became possible in December 1951 when the hospital ship U. S. S. *Consolation* was placed above the 38th parallel off the east coast of Korea. Equipped with an EEG machine, and a helicopter flight deck that facilitated the reception of patients, initial tracings were secured within a few hours of the time of injury. Subsequent tracings were obtained aboard ship and, with the transfer of patients, at the base hospital in Japan.

W. M. Welch Manufacturing Company (Booths 47 and 48). The W. M. Welch Manufacturing Company will exhibit high vacuum pumps; balances; electric meters; electronics teaching devices; scientific charts; sets of charts for biology, physics, and physiology; hemoglobinometer; paper chromatography instruments; Densichron (densitometer); and other instruments for physics, chemistry, and biology teaching and research.

Western Union Telegraph Co. (Corridor). Western Union Telegraph Co. will have a display of their latest facsimile equipment designed for customer use.

Wood and Metal Products (Booth 31). Wood and Metal Products will exhibit Bouyoucos Apparatus for Soil Moisture Determination. The resistance method of

determining the amount of water in the soil was developed during the 1930s by George John Bouyoucos, research professor in soils science, Michigan State College. Apparatus for use with this method was developed with the cooperation of Wood and Metal Products, of Bloomfield Hills, Mich., and came into use in 1940. Apparatus: (1) Bouyoucos Model C Bridge: combines rugged, compact construction with a high degree of sensitivity, for field and laboratory use; (2) Bouyoucos Moisture Meter: a practical, scientific guide to irrigation practices; (3) Plaster Resistance Unit: buried in the soil, this sensitive element gives a measure of soil moisture when used with the bridge or the meter; (4) Nylon Resistance Unit: two pieces of fine stainless steel screen, acting as electrodes, are separated by wrappings of nylon and contained in a perforated metal case which affords extensive exposure to the soil. Used only with the Model C bridge. After a decade of field use by large commercial outfits and laboratory use by agricultural and other scientific research organizations in many parts of the world, the Bouyoucos method of soil moisture determination is considered first in its field. As is true of any scientific apparatus, field use and laboratory experiment constantly suggest improvements.

News and Notes

Autumn Meeting, American Physiological Society

THE American Physiological Society holds two meetings annually—one each spring with the Federation of American Societies for Experimental Biology, and one each autumn more informally on a university campus. This autumn the society met Sept. 4–6 in New Orleans at Tulane University, with half a day at Louisiana State University Medical Center. The Tulane campus provided outdoor beauty, dormitory accommodations, a cafeteria, and an air-conditioned building for sessions. Arrangements were made entirely by the local committee, of which H. S. Mayerson was chairman. Some 230 papers were presented and discussed during four half-days of sessions, usually in six simultaneous programs. There were 390 registered attendants. President E. M. Landis presided at the business sessions of the society and at the meetings of the council. Past President R. W. Gerard spoke on "Becoming an Elder Statesman" at the society dinner.

The council enlarged the standing Committee on the Use and Care of Animals. Its object is to re-emphasize the responsibilities of physiologists in procurement, in humane treatment, in training of workers with respect to animal care, and in publication of the results of the experiments. It will receive and consider suggestions concerning animal care. H. E. Essex, Mayo Foundation, Rochester, Minn., is chairman.

The Porter Fellowship of the society was redefined in terms of its usefulness for training candidates in research and in teaching. It may be either postdoctoral or predoctoral and carries a $3000 annual stipend. Applications are received from nonmembers as well as from members. H. W. Davenport, University of Utah, is chairman of the committee.

The society is seeking varied methods of improving both formal and informal communication at its meetings. Panels, debates, and *conversazioni* are planned. F. A. Hitchcock, Ohio State University, is chairman of this committee. General problems of programming are also being explored by a committee whose chairman is A. B. Hertzman, St. Louis University School of Medicine.

The survey of physiological science (SCIENCE, 115, 3, June 20 [1952]), being made with the support of the National Science Foundation, is in full swing, with headquarters at the Washington office of the society, 2101 Constitution Ave. It has collected and organized an array of questions and is devising methods of securing sound data to answer them. It is concerned with trends, institutions, personnel, finances, education, research, and communications in physiological science. R. W. Gerard, University of Illinois, is chairman of the Central Committee, and Orr E. Reynolds is director of the first phase of the survey.

Adherence to the International Union of Physiological Science, now in process of organization, has been voted by the society. Mechanisms of adherence and specific proposals to the International Union of Physiological Science are being considered. M. B. Visscher, University of Minnesota, is chairman of the American delegates.

The president-elect, E. F. Adolph, University of Rochester, will visit five institutions this fall. The area selected on the basis of invitations received includes North Carolina, Tennessee, and Kentucky. The purpose is to explore problems that face physiologists in teaching, research, and education, and incidentally to present similar discussions on a selected topic.

The society, now 65 years old, has as its objective the advancement of physiology as one of the biological sciences. At present, new avenues of interest are opening. The society publishes three journals, the *American Journal of Physiology*, *Physiological Reviews*, and the *Journal of Applied Physiology*. It depends on the voluntary work of its 1300 members and on its central office for all its organized efforts.

The spring meeting will be held April 6–10, 1953, in Chicago. The 1953 autumn meeting will be omitted, since the triennial International Congress on Physiology will meet in Montreal Aug. 31–Sept. 4, under the presidency of C. H. Best.

EDWARD F. ADOLPH
School of Medicine and Dentistry
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Scientists in the News

The 1952 Human Relations Award for the Society for the Advancement of Management has been presented to **Lawrence A. Appley,** president of the American Management Association. The award, a scroll and key, is given annually for outstanding accomplishment in the human relations field. **William R. Mullee,** of New York University, received the society's Gilbreth Medal for achievement in the field of motion study.

F. Clark Cahill has been made chief engineer of the Engineering and Production Division of Airborne Instruments Laboratory, Inc. An electrical engineer, Mr. Cahill formerly served in the division as supervisor of the Radar Section.

Carlyle G. Caldwell has been elected an assistant vice president of National Starch Products Inc. He joined National's research staff in 1940 and has been research director since 1948.

Joseph H. Camin, formerly of Ohio State University and South Dakota State College, has joined the staff of the Chicago Academy of Sciences as curator of invertebrates. His field of research is the taxonomy and biology of mites.

Ralph I. Dunlap, of Longmeadow, Mass., has been appointed assistant director of research for Monsanto Chemical Company's Plastics Division, Springfield. Dr. Dunlap joined the division in 1943 as a research chemist.

R. Adams Dutcher, professor emeritus, Pennsylvania State College, has been appointed special lecturer and consultant in nutrition at the University of Florida.

Fred T. Foard, Public Health Service medical director and chief, Branch of Health, Bureau of Indian Affairs, retired on Oct. 31, after 36 years of service. Dr. Foard will become director of the Division of Epidemiology, North Carolina State Department of Health.

T. Keith Glennan, for more than two years a member of the Atomic Energy Commission, has resigned because commitments to the Case Institute of Technology at Cleveland have made it necessary for him to return. Dr. Glennan's term was to have expired June 30, 1955. He came to the commission from the presidency of Case Institute in August 1950.

Crawford H. Greenewalt, president of E. I. du Pont de Nemours & Co., received the gold medal of the Society of Chemical Industry for "conspicuous service to applied chemistry." Robert C. Swain, Cyanamid Company, presented the award, and Harry B. McClure, vice president of Carbide and Chemicals Corporation, presided at the award meeting.

C. Lee Huyck, director of the Division of Pharmacy, Howard College, Birmingham, Ala., is now professor of industrial pharmacy at the St. Louis College of Pharmacy and Allied Sciences.

Ewart R. H. Jones, Sir Samuel Hall professor of chemistry at the University of Manchester, has been appointed Arthur D. Little visiting professor of chemistry at MIT. Professor Jones was named reader in organic chemistry at the University of London and assistant professor at the Imperial College in 1946 and was invited to the chair of chemistry at the University of Manchester in 1947. The professorship that Dr. Jones holds at MIT has been established out of a bequest of funds left to the Institute by the late Arthur Dehon Little, a graduate of MIT in 1885.

New chairman of the U. S. National Commission for Unesco is **Walter H. C. Laves.** He succeeds **Luther H. Evans,** Librarian of Congress. Mr. Laves served as deputy director general of Unesco in Paris 1947–50. He is vice president of the privately endowed Governmental Affairs Institute, Washington, D. C., and consultant to the U. N. Technical Assistance Board. The following vice-chairmen were elected: Robert C. Angell, Helen Bragdon, and Stanley H. Ruttenberg. New members elected to the executive committee were Gordon R. Clapp, Marc Connelly, Charles E. Odegaard, George N. Shuster, and Henry R. Hope.

Rafael Lorente de No, neuroanatomist, has been appointed chief of the Laboratory of Neuroanatomical Sciences at the National Institutes of Health. He will head a laboratory composed of groups working on cytoarchitecture, functional neuroanatomy, developmental neurology, and chemical morphology. Dr. Lorente de No will leave his post as Member at the Rockefeller Institute for Medical Research to assume his new duties on Feb. 2.

R. A. McCance, professor of experimental medicine at Cambridge University, England, will visit the Army Medical Service Graduate School, Washington, D. C., on Dec. 15 for a conference on the effects of undernutrition on the composition of the body.

James H. McMillen has joined the staff of the National Science Foundation as a member of the physics staff of the Division of Mathematical, Physical and Engineering Sciences. Dr. McMillen was chief of the Hyperballistics Division, Naval Ordnance Laboratory.

Amos Pucklajohn Maxwell has joined the faculty of the State College of Washington as reference librarian in the Science Division of the Holland Library.

Frank R. Milliken has joined the Kennecott Copper Corporation as a vice president and will assume supervision of its mining operations in this country and in Chile. Mr. Milliken was an experimental engineer with the Utah Copper Company, a Kennecott sub-

sidiary, and later joined the National Lead Company in 1941, serving as plant manager of its MacIntyre development, and most recently as assistant manager of its Titanium Division and member of its Mining Committee.

Samuel Morford, clinical psychologist with The Personnel Laboratory, New York City, has been appointed director of Psychological Services (Canada) and will take over his new duties at the laboratory's Toronto office on Dec. 10.

Charles M. Mottley has been appointed to succeed **S. D. Cornell** as director of the Planning Division of the Department of Defense Research and Development Board. Dr. Cornell, who has been with the board since 1946, and has been director of the Planning Division since 1949, has accepted a position as executive officer of the National Academy of Sciences and the National Research Council.

William O. Pool has been promoted from senior research chemist to the newly established position of research associate at Don Baxter, Inc., Glendale, Calif.

David E. Price has been appointed to the newly created post of assistant surgeon general of the Public Health Service. Dr. Price has been associate director of the National Institutes of Health for the past two years. **C. J. Van Slyke** has been appointed associate director to succeed Dr. Price, and **James Watt** has been assigned to Dr. Van Slyke's post as director of the National Heart Institute.

Lawrence M. Rohrbaugh has been appointed chairman of the Department of Plant Sciences at the University of Oklahoma, replacing **Howard W. Larsh.** Dr. Larsh has been granted a leave of absence in order to conduct research on *Histoplasma capsulatum* and other mycotic pathogens at the Communicable Disease Center, U. S. Public Health Service, Kansas City, Kan.

Robert B. Sleight is president of the newly organized Applied Psychology Corporation, 1129 Vermont Ave., N.W., Washington, D. C. He was formerly with the Psychological Laboratory of the Institute for Cooperative Research, The Johns Hopkins University.

Robert W. Sperry, assistant professor of anatomy at the University of Chicago, has joined the combined research program of the National Institute of Neurological Diseases and Blindness and the National Institute of Mental Health, U. S. Public Health Service. Dr. Sperry, who is well known for his research on developmental organization of the nervous system, has been appointed chief of the Section on Developmental Neurology in the Laboratory of Anatomical Sciences.

Julian C. Stanley, associate professor of educational psychology at George Peabody College for Teachers since June 1949, has been appointed associate professor of education at the University of Wisconsin, effective June 1953. Currently he is president of the Tennessee Psychological Association, chairman of the Psychology Section of the Tennessee Academy of Science, trustee of Test Research Service, and research adviser to the American Institute for Research.

Herbert E. Stokinger has been appointed chief toxicologist in the Division of Occupational Health, U. S. Public Health Service, replacing **L. T. Fairhall,** who is now affiliated with Yale University. As head of the Toxicology Section of the Occupational Health Field Headquarters in Cincinnati, Dr. Stokinger is in charge of laboratory investigations in toxicology for the division.

Otto Struve will give the Albert A. Michelson Memorial Lecture at the China Lake Branch of Scientific Research Society of America on Dec. 15. This commemorates the birth of Dr. Michelson on Dec. 19, 1852.

Education

The **University of Buffalo** will give a graduate course in chemical marketing in its 1952–53 evening sessions. Jointly sponsored by the departments of Chemistry and Marketing, the course will be given by Frank P. Greenspan, of the Research and Development Department of Buffalo Electro-Chemical Company, Inc.

A **Corrosion Short Course** will be given Feb. 2–6 at the University of California, Berkeley, by the Extension Department and the departments of Mechanical Engineering, Mineral Technology, and Chemical Engineering, in cooperation with the National Association of Corrosion Engineers. More than a dozen speakers, representing industrial and governmental laboratories and academic institutions will discuss basic corrosion science theory, application of corrosion mitigation measures, and the role of the corrosion engineer in industry. W. F. Seyer, of the University of California, Los Angeles; N. Hackerman, of the University of Texas; A. Wachter, of Shell Development Company; Mark F. Adams, of Washington State Institute of Technology; and I. Cornet, of the University of California, Berkeley, will act as chairmen of the various sessions.

The **State University of Iowa** is planning the establishment of an Iowa Institute of Gerontology as a research center to study social, medical, biological, psychological, and economic problems of the aged.

A series of three two-week courses in **Radiological Health Protection,** including technical laboratory procedures, will be presented tuition-free in Cincinnati, beginning Jan. 9. Each succeeding course is dependent upon information gained in the preceding weeks, but a student's previous training and experience may permit him to enter the second or third program directly. For full information, write Chief, Radiological Health Training Section, Environmental Health Center, 1014 Broadway, Cincinnati 2.

Grants and Fellowships

Recent **AAAS Research Grants**, awarded through state academies of science, included the following: Arkansas Academy of Science, for the work of P. M. Johnston and John A. Sealander; Kentucky Academy, in support of the work of Mary Wharton; New Hampshire, for A. L. King; North Dakota, for George C. Wheeler; Pennsylvania, for R. W. Stone and Clarence K. Williamson; South Dakota for R. J. Greb; and West Virginia Academy of Science for research by Madeleine Feil and Dorothy Fisher.

The **Atomic Energy Commission** is offering eight fellowships in industrial medicine for 1953–54. Awards are for one year's academic training at approved institutions that can provide special training facilities in the health problems associated with the atomic energy program. In-plant training will be given the second year in medical departments of major AEC plants and laboratories. Stipends are $3600 and $6000. Applications must be submitted by *Jan. 1* to Henry A. Blair, University of Rochester, Rochester, N. Y.

The **New England Textile Foundation** is accepting applications from high school graduates for four-year scholarships worth $2000 each. Candidates may be selected from any area, but winners will study at Bradford Durfee Technical Institute, Lowell Textile Institute, New Bedford Textile Institute, or the Textile School of Rhode Island School of Design. For full information address George T. Metcalf, 68 S. Main St., Providence 3, R. I.

In the Laboratories

Du Pont will start construction early next year of a plant on the Scioto River, south of Circleville, Ohio, for the manufacture of Mylar polyester film, a new product that, in its transparent form, looks like cellophane. Studies of Mylar indicate that it will be useful in electrical insulation and for various kinds of tape. Full development awaits completion of the Circleville plant.

Ethyl Corporation has reorganized its Research and Engineering Department so that it will consist of three major divisions, two of which are new—the Production Application Division, under Richard K. Scales, and the Automotive Products Research Division, under Wheeler G. Lovell. The Chemical Research and Development Division, under George Kirby, will continue to function essentially unchanged. J. B. Macauley is director of research for Ethyl.

Fisher Scientific Company has appointed Richard C. Schleck director of the Reagent Chemicals Division, Pittsburgh. Clifford A. Flanders, now director of chemical production, will coordinate all chemical manufacture, packaging, and distribution in the U. S. and Canada, from the New York office.

Hunter Associates Laboratory has been formed by Richard S. Hunter, formerly chief optical engineer with the Henry A. Gardner Laboratory. Associated with Mr. Hunter will be Marshall Powell, of the Gardner Laboratory, and James D. Ferguson, Jr., a mechanical engineer formerly with Aviation Corporation. The new organization will be located at 5421 Brier Ridge Road, Falls Church, Va.

Lever Brothers Company opened its new Research Center at Edgewater, N. J., Nov. 18, in ceremonies commemorating its research golden anniversary. J. R. Killian, Jr., made the principal address, at a luncheon following inspection of the laboratories. The five operating departments of the center are headed by L. B. Parsons, director of the Research and Development Division.

Libbey-Owens-Ford Glass Company has acquired the properties and assets of the Corrulux Corp., of Houston. As the Corrulux Division, it will be under the general direction of G. P. MacNichol, Jr., and will be headed by Joseph S. Finger, president and founder of Corrulux.

Arthur D. Little, Inc., has appointed Bernard Vonnegut, of the G-E Research Laboratory, to its Physical Chemistry Group, where he will do research on nucleation phenomena. Robert C. Hockett, former scientific director of the Sugar Research Foundation, has also joined the Little organization.

The **Matheson Company, Inc.**, of East Rutherford, N. J., has purchased control of **Coleman & Bell Company**, of Norwood, Ohio. William H. Bell will temporarily continue as head of Matheson Coleman & Bell until a new president is appointed, after which he will remain with the company in an advisory and executive capacity. Laboratories and chemical personnel of Matheson will eventually be transferred to Norwood.

The **W. L. Maxson Corporation** has elected S. Merrill Skeist vice president in charge of the Contracts Division. Other appointments in the division include John W. Bjorkman, executive assistant to the vice president and manager, Planning Department; J. Labarre Comer, Administrative Department; William P. McNally, manager, Air Force Contracts Department; John J. Ryan, manager, Navy Contracts Department; and Albert J. Colton, manager, Army Contracts Department.

The **Wm. S. Merrell Company** has opened a new research laboratory in Cincinnati especially designed for the safe study of tuberculosis and other diseases caused by microorganisms. F. Joseph Murray is head of the new laboratory.

The **Upjohn Company** has elected Donald S. Gilmore chairman of the board and managing director to succeed L. N. Upjohn, who will retire on Jan. 1. E. G. Upjohn, an executive vice president, was elected president. Other changes in the Upjohn organization include the appointment of D. I. Weisblat as assistant

director of research; Robert H. Levin as head of the Chemistry Department, and H. F. Hailman as director of the Department of Clinical Investigation.

Meetings and Elections

The **Association of Urban Universities** elected T. R. McConnell, of the University of Buffalo, president at its annual meeting in Detroit. R. W. Van Houten and David D. Henry continue as vice president and secretary-treasurer, respectively.

The **Audio Engineering Society,** meeting in New York, installed F. Sumner Hall as president, and Jerry B. Minter, Walter S. Pritchard, and Richard L. Burgess, vice presidents. C. J. LeBel and Ralph A. Schlegel were elected secretary and treasurer, respectively. The society is offering a Scholarship Award for 1953 to a student of science or engineering, to be awarded at the Audio Fair in October next year.

The **Institute of Metals,** London, has elected the following officers: president, F. C. Thompson, of the University of Manchester; vice presidents, C. J. P. Ball, of Magnesium Elektron, Ltd., and G. V. Raynor, of the University of Birmingham. S. F. Dorey, of Lloyd's, was elected senior vice president; he will be the nominee for the presidency in 1954–55. The institute will present two prizes of 20 guineas each for the best student essays relating to metallurgy, except that those dealing exclusively with extraction and ferrous metallurgy are excluded.

The **Institute of Radio Engineers** has elected James W. McRae president, succeeding Donald B. Sinclair. S. R. Kantebet, of the Government of India Overseas Communications, will succeed Harold L. Kirke as vice president. Stuart L. Bailey and B. E. Shackelford were elected directors for 1953–55.

The second annual **Symposium on Blood** will be held at Wayne University College of Medicine, Jan. 17, at which a number of outstanding investigators will present papers. A printed program will be available early in January.

A **Symposium on Fundamental Biology** will be held at Michigan State College Feb. 2–4. A series of eight lectures on "Proteins and Protein Metabolism" will be given by Henry Borsook, Erwin Chargaff, Felix Haurowitz, and Charles Heidelberger. For full details, write to Alfred Novak, of Michigan State's Department of Natural Science.

The **United States National Committee** of the International Commission on Irrigation and Drainage has elected Walter E. Blomgren chairman. Seventeen countries convened at the commission meeting in September to approve acceptance of the U. S. as a member-country. Other members elected to serve on the committee include G. T. McCarthy, A. P. Rollins, I. D. Wood, S. M. Gross, H. A. Scott, and Harold Conkling. The next international meeting of the commission is scheduled for April 1954 in Algiers.

The **World Medical Association,** in conjunction with the **Pan American Medical Confederation,** will hold its first Western Hemisphere conference in Richmond, Va., Apr. 23–25. The conference will celebrate the diamond anniversary of medical progress. Sessions will be held at the Medical College of Virginia and at the Jefferson Hotel. For further information, address the Arrangements Committee, Suite 3201, 444 Madison Ave., New York 22.

Miscellaneous

The **American Chemical Society** has established a Charles Lathrop Parsons Award, named for its retired secretary. The award will be given not oftener than once every three years to a chemist or chemical engineer chosen solely for outstanding public service. First presentation will be made to Dr. Parsons at a dinner in his honor in Washington, D. C., Dec. 6. The award will consist of an appropriate scroll and the privilege of choosing the recipient of a $2000 graduate scholarship.

The following people visited Atlantic Region Headquarters of the **U. S. Geological Survey** during August: J. N. Bramloger, Topographic Surveys, the Netherlands; H. A. Razmara, Chef du Service Géographique de l'Armée Imperiale, Teheran; and Antonio Carlos B. Carvalho (Point IV program).

The **Loubat Prizes,** established in 1892 and given in recognition of the best works published in the English language on the history, geography, archaeology, ethnology, philology, or numismatics of North America, will be awarded by Columbia University in 1953. The competition is open to citizens of all countries, and awards are made every five years. For full information, address the secretary of Columbia University, New York 27. Deadline for entries is *Jan. 1.*

The **South African Council for Scientific and Industrial Research** recently issued its annual report for the year ended Oct. 4, 1951. The council now has a staff of 350, with approximately 120 temporary members. Its budget of £46,000 is used chiefly to subsidize the six Industrial Research Associations and the South African Institute for Medical Research, as well as a small number of research fellowships (59) and assistantships (21). Although the projects sponsored by the National Chemical Research Laboratory and the National Physical Laboratory include several that are devoted to pure science, it is natural that the emphasis should fall on applied research, and among the activities that seem to be of especial interest are researches on clay minerals and their industrial uses, on the Transvaal chromite deposits, spontaneous combustion of coal, decomposition of dolomite, and the effectiveness of superphosphates on South African soils. The report announces the appointment of a National Institute for Personnel Research, with the implication that the supply of scientific and technical personnel constitutes a problem of growing magnitude in the Union of South Africa.

Technical Papers

The Effect of Neutron Bombardment on the Low Temperature Atomic Heat of Silicon

P. H. Keesom,[1] K. Lark-Horovitz, and N. Pearlman[2, 3]

Purdue University, West Lafayette, Indiana

Experiments at Purdue with 10 mev deuterons and at Oak Ridge with fast neutrons have indicated that irradiation produces both electron and hole traps in silicon, since both *N*- and *P*-type materials become very poorly conducting (resistivities as high as 250,000 ohm-cm have been reached in this way). Thus a result of the lattice disorder (vacant sites and interstitial atoms) produced by elastic collisions is the removal of free carriers (*1, 2*). Since annealing at 450° C restores the initial conductivity, it appears to remove the electron and hole traps and to release the trapped carriers; hence, any electronic (or hole) contribution to the atomic heat at very low temperatures should be decreased by bombardment and then restored by annealing at elevated temperatures.

The lattice contribution to the atomic heat at very low temperatures should also be sensitive to bombardment because of the dependence of the thermal vibrations on the interatomic forces, which in turn are affected by the disordering of the lattice (*3–5*). This has been known for some time from the investigation of the specific heat of the so-called metamict crystals (*6*), in which the bombardment is produced by radioactive inclusions in the lattice.

In order to see whether such changes could be observed experimentally, the atomic heat of a silicon ingot[4] was measured before and after exposure to about 5×10^{18}/cm^3 neutrons in the nuclear reactor at Oak Ridge. The sample was then annealed at several temperatures up to 780° C (Table 1), being held at each temperature for the time indicated, and then cooled at about 10° C/hr. Its heat capacity below 5° K was measured after each heat treatment.

The experimental method was similar to that of Nernst and Eucken (*7*) and has been described in detail elsewhere (*8*). At very low temperatures, the contribution of the lattice to the atomic heat will be given by (*9*)

$$1944(T/\theta)^3 = \alpha T^3 \text{ J/mole degree}, \qquad (1)$$

where θ is the Debye temperature. The contribution of the carriers can be written (*10*)

$$1.62 \times 10^{-12} V n^{1/3} \mu T = \gamma T \text{ J/mole degree}, \qquad (2)$$

[1] Assisted by Signal Corps contract.

[2] Assisted by AEC contract.

[3] We would like to thank D. Finlayson for his measurements of the Hall constant, and L. Roth for the probe measurements and heat treatments.

[4] The ingot weighed about 260 g, and was kindly supplied by G. L. Pearson, of the Bell Telephone Laboratories. Its impurity concentration was not known.

where V is the atomic volume, n is the carrier concentration per cm^3, and μ is the ratio of carrier mass to electron mass. Other evidence indicates that this ratio is about unity for carriers in silicon (*11*); hence, the total atomic heat should have the form

$$C_v = \alpha T^3 + \gamma T \qquad (3)$$

at very low temperatures. We verified this form of temperature-dependence for our data by plotting C_v/T vs. T^2 and observed that the points scattered about a straight line for each run. The slope α and intercept γ were calculated by least squares, and θ (calculated from α using Eq. [1]) and γ are listed in Table 1.

TABLE 1

LATTICE AND CARRIER CONTRIBUTIONS TO ATOMIC HEAT OF SILICON AS A FUNCTION OF BOMBARDMENT AND HEAT TREATMENT

	Run	N	θ (°K)	γ-J/mole degree^2
1	Si II—before bombardment	18	645	13.03×10^{-4}
2	" " " "	33	659	22.51
3	" " " "	35	661	22.51
	Runs 1, 2, and 3 combined	86	658	21.02
4	Si IIB—after bombardment	18	633	1.11
5	" " " "	20	640	1.96
	Runs 4 and 5 combined	38	637	1.55
6	Si IIB(A1)—anneal at 135° C (24 hr)	15	628	−0.91
7	Si IIB(A2)—anneal at 253° C (24 hr)	17	632	0.43
8	Si IIB(A3)—anneal at 472° C (24 hr)	16	628	−2.08
9	Si IIB(A4)—anneal at 455° C (48 hr)	13	637	1.74
	Runs 6, 7, 8, and 9 combined	61	632	−0.03
10	Si IIB(A5)—anneal at 780° C (24 hr)	14	642	13.69

The number of heat capacity measurements made during each run is given in the third column of the table.

The electronic term became very small after bombardment and remained small after the first four anneals. There would appear to be no significant change in the electronic term after any of these treatments, whereas the last anneal restores the original linear term, within the accuracy of our measurements. We attempted to determine n, the carrier concentration, independently from measurements of the Hall constant, but the agreement found with n determined from Eq. (2) (about 10^{18}cm^{-3} before bombardment) is inconclusive, since probe measurements of the large ingot showed it to be very inhomogeneous, with both *N*- and *P*-type regions of high and low conductivity.

The effect on the Debye temperature is not as clear, although it also appears to decrease after bombardment and to rise after the last heat treatment. The initial decrease would imply that the decrease of elastic constants attributable to vacancies predominates over the increase due to interstitial atoms. Dienes' calcula-

tions for copper and sodium (*3–5*) show that this situation would be favored in an open lattice, such as the diamond structure in which silicon crystallizes.

Our results thus lend further support to the idea that lattice disorder produced by neutron bombardment results in carrier traps in silicon which can be healed out by suitable heat treatment. It also confirms the division of the total atomic heat into two parts, as indicated by Eq. (3), and the identification of the linear term with the contribution of the carriers.

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Manuscript received September 15, 1952.

Note added in proof: Another more homogeneous B.T.L. Si sample (Si V) has been investigated, and the results obtained agree with the results given above: $\theta_{orig} = 658°$ K, $\theta_{bomb} = 636°$ K; $\gamma_{orig} = 34.6 \times 10^{-4}$, $\gamma_{bomb} = 9.26 \times 10^{-4}$. Heat treatment again restores the electronic specific heat.

Insecticidal Effect of Inert Solid Diluents

T. C. Helvey

New York State University Teachers College, Oneonta

It has been known for many years that the inert diluents in insecticide dust mixtures have an influence on the toxicity of these mixtures. Many attempts have been made to determine the governing factors of this phenomenon (*1–3*). The answer is not only of scientific interest, but it is of great importance for insecticide manufacturers too, because it will help to select the most effective diluents.

The killing effect of the inert diluents is more likely to be related to the physical than to the chemical properties of the material.

The first step in this investigation was to locate the diluent particles when dusted onto the insect. It was thought that the smallest particles would enter the body of the insect through the mouth or spiracles and might cause fatal injuries to internal organs or interfere with their function (*4*). The second well-founded alternative, as advocated by Wigglesworth (*5*), claimed that the killing effect was due to an abrasive action on the exocuticle, with subsequent dehydration of the insect.

The diluent was coated with a fluorescent compound, Aesculin, for easier tracing of the small particles.

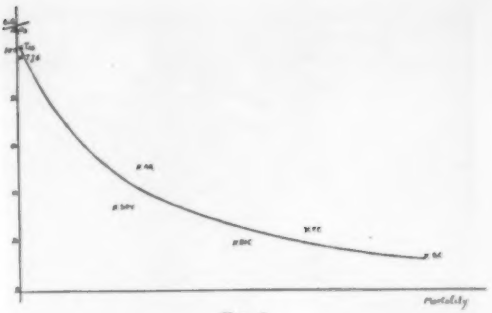

Fig. 1.

After the death of the insects they were examined externally and internally with the ultraviolet microscope, but no evidence could be found for the diluent particles having entered the body of the insects.

It was observed that the death of the larvae treated with coated silicates was retarded somewhat, as compared with insects treated with the same, but not coated diluent. This shows the harmlessness of the fluorescent compound, but no proper explanation could be given for the prolonged survival of the larvae. An agglomeration of smaller, microscopic particles as a result of the coating process is possible, since the diluent treated with distilled water gave similar delaying effect.

It was considered that the shape of the diluent particles or their crystal structure might bear a relation to the mortality of the larvae. Therefore the experiments were extended in this direction. Mexican bean beetle larvae were again used, since the effect of various diluents on the same insect had been already in-

Fig. 2. EMTCO 23 T (T 23). No mortality.

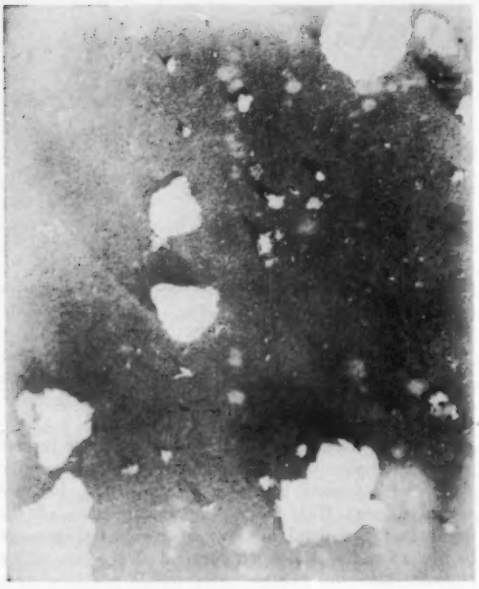

FIG. 3. Fuller's earth (FE). High mortality.

vestigated (*6*). The repetition of these experiments, however, gave in some instances significantly different results from those already published—this in spite of identical materials and conditions. Nevertheless, the trend of the effect of the different diluents was quite distinct, and the results could be used for a first approach.

For further experiments, about 24-hr-old third and fourth instar Mexican bean beetle larvae were used. They were exposed qualitatively to various aluminum silicate dusts and kept in a Petri dish while feeding on bean leaves. In each experiment 10 larvae were used, and mortality counts were made after 24, 48, and 72 hr. Because of inadequate supply of larvae, only those experiments were repeated which gave 25% or higher mortality in 24 hr. The silicates were screened with a 200-mesh sieve and dried in a desiccator. The temperature was 75° F, and the RH 48% in all experiments. Adequate untreated controls were under identical conditions.

Most effective of the diluents used were: Barden clay and Attaclay, fuller's earth and asbestine, Bancroft clay; least effective, EMTCO 23 Talc, Filtrol X-415, and Talc No. 6-J.

It was found that if the SiO_2: Al_2O_3 ratio of the above diluents was plotted against the mortality of Mexican bean beetles, in many cases the mortality increased with decreasing ratio of the SiO_2: Al_2O_3 (Fig. 1). Since the solubility of these compounds in the fluids and lipids of the insect body is quite negligible, the shape and the structure of the microcrystals had to be investigated. From all the above-mentioned powders x-ray diffraction pictures were taken, and the resulting Debye-diagrams recorded and evaluated by using a microphotometer, but no coherent or convincing explanation of above phenomenon could be achieved by this method.

The pictures of the inert diluents, taken with the electron microscope, have resulted in some information, yet it is contrary to expectation. Those diluents with little or no insecticidal effect show sharp edges and points (Fig. 2), whereas the highly effective members of above series appeared much less "abrasive" (Fig. 3). This could indicate that the dusts probably absorb, more than abrade, the waxy layer of the exocuticle or that the combined action is responsible for the effect of inert diluents on insects.

It is obvious that more research has to be done to elucidate these interesting problems of insect physiology. The use of different kinds of insects and other methods and materials may bring forward the answer. Such experiments are in progress and will be reported when completed.

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Uranium in the Clay of a Black Radioactive Shale

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The location of uranium in black shales is not well understood, and various reports suggest different loci for the element. McKelvey and Nelson (*1*) summarize the possibilities well as follows: "In fact, it is possible that no distinct uranium-bearing mineral is present in many of the shales, for the uranium may be in an organic compound or the uranium ion may be held by ion exchange, or by adsorption on organic matter or clay minerals, or as impurities in the crystal lattice of common minerals." The results of a brief study of a black radioactive shale from Ste. Genevieve Co., Mo., show that the uranium contained in it is located predominantly in a relatively fixed condition in the fine clay fraction, and not in the black organic matter.

This result is at variance with the suggestion (*1*, p. 40) "that the uranium in the black shales is more likely attached to organic matter than to clay" and does not support Frederickson's suggestions (*2*) that the UO_2^{++} ion may be "adsorbed between the graphite layers of carbonaceous material, forming a strong structure due to the stable UO_2^{++} holding the two layers together." On the other hand, simply because the uranium was not in closest association with the organic matter in

the shale, it does not follow that the same relationships hold universally.

A thin black shale layer in the Spergen limestone 5½ miles north of Ste. Genevieve, Mo. (*3*), is radioactive and apparently was the source of the constituents that gave rise to a carnotite film on limestone below. The shale was found by spectrographic analysis to contain uranium and vanadium.

Shale visibly barren of carnotite was disaggregated and separated into size fractions as follows: coarse fraction > 4 μ (settling equiv to spheres); medium fraction, 1–4 μ; fine fraction, 1–0.2 μ; and superfine fraction < 0.2 μ (*4*). The coarse and medium fractions contained illite, quartz, and calcite, and the finer fractions contained only illite, as shown by x-ray powder diffraction patterns. Carbon was concentrated progressively in the finest fractions as shown by darker colors, and by more pronounced exothermic reaction in differential thermal analysis.

The uranium content of the fractions was tested by fusing .05 g of a 1 : 1 mixture of shale and a standard kaolinite, with 2 g sodium fluoride, and by comparing the fluorescence of the fusion under the ultraviolet light (Mineralight) with a standard arbitrary scale of shale-kaolinite mixtures. The medium and fine fractions of the shale showed unit fluorescence, the coarse fraction fluoresced equivalent to a one-half shale mixture, and the superfine fraction fluoresced equivalent to a one-tenth shale mixture. Hence, the shale fraction richest in carbon gave the weakest fluorescence, from which it is concluded that the uranium is concentrated in the clay and not in the carbon fractions.

Leaching experiments were conducted to determine the ease of removal of uranium. Two g shale was stirred and allowed to stand in 50 ml solvent for 24 hr. After filtering, the filtrates were evaporated to 15 ml, and 10 drops of each was fused with 2 g sodium fluoride. Hydrochloric, nitric, and sulfuric acids, aqua regia, and dilute sodium carbonate were effective solvents, but hot and cold water, ethyl alcohol, carbon disulfide, and carbon tetrachloride did not extract enough uranium to produce fluorescence. Normal propyl alcohol dissolved a small amount, which fluoresced weakly.

Attempt to exchange the uranium cationically was made by mixing 10 g pulverized shale with 1 liter 0.1 *N* KCl and with 1 liter 0.5 *N* $BaCl_2$. Cations of barium and potassium were chosen for exchange because of their relatively large sizes, which are comparable to the uranium and UO_2 ions. After thorough shaking, the suspensions were allowed to stand for 24 hr and then filtered. The filtrates and the clay residues were tested for uranium by the fluorescence methods described above. The filtrates, however, showed no fluorescence, and the clay residues four fifths the intensity expressed as unity; hence, it is concluded that the uranium is held by the clay minerals in a condition not easily exchangeable.

In the absence of further data on behavior of the uranium in the clay it is perhaps best to forego unsupported speculation as to where the uranium resides. Apparently it is with the clay, not primarily with the carbon, and is not easily exchangeable as a cation.

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Chromatography in the Purification of Staphylococcal Enterotoxin

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Several methods have been employed for the purification of staphylococcal enterotoxin (*1*), but none has been entirely satisfactory. In an attempt to purify the enterotoxin chromatographically we have found diatomaceous silica to be a satisfactory adsorbent. Other investigators have used this material successfully for the purification of a variety of substances (*2–5*).

The enterotoxin samples were prepared for chromatographing by precipitation from saturated $(NH_4)_2SO_4$ solutions or by precipitation from solution at pH 3.5 (*1*). When these samples were dissolved in citrate-phosphate buffer solution of pH 6.35 and 0.02 ionic strength and passed through a column

TABLE 1

Enterotoxin Adsorption on Hyflo Super Cel

Expt No.	Treatment of crude enterotoxin	Equivalent amount fed* (ml)	Mg fed	Mg *N* fed	Monkey feeding results† (No. positive /No. fed)
1	$(NH_4)_2SO_4$ precipitation	200	7.4	0.670	5/30
1a	$(NH_4)_2SO_4$ precipitation, adsorption on Hyflo Super Cel	200	0.172	0.009	0/6
		1000	0.860	0.045	5/6
2	Dried	40	416.8	37.7	1/6
		200	2084.0	188.4	4/6
2a	pH 3.5 precipitation, adsorption on Hyflo Super Cel	200	0.260	0.020	2/6
		400	0.520	0.040	6/6

* Volume of crude toxin solution used to obtain the amount of material fed.

† Assay for the presence of enterotoxin was made by feeding the samples in solution to young rhesus monkeys by stomach tube. Vomiting within 5 hr was accepted as a positive reaction for enterotoxin.

containing 1 g of Hyflo Super Cel[1] for each 1.5 mg of enterotoxic material, complete adsorption of the enterotoxin was achieved. Elution was obtained by washing the column with 10 ml of citrate-phosphate buffer solution of pH 7.8 and 0.12 ionic strength for each gram of adsorbent. The procedure was performed at 5° C. The eluate was dialyzed, centrifuged, and lyophilized. Even though the activity of enterotoxin cannot be determined quantitatively, the results (Table 1) do indicate a ten- to twentyfold purification by the chromatographic procedure.

The material obtained by this method contained very little carbohydrate (probably less than 5%). It gave a positive ninhydrin reaction and a color reaction equivalent to that given by proteins with the method of Lowry *et al.* (*6*). Examination by the Oudin immunological technique (*7*) showed the presence of at least four antigens, of which only two were concentrated by the chromatographing. Preliminary electrophoretic examination showed at least two substances to be present, one of which was toxic and one nontoxic. The toxic material contained about 80% of the nitrogen.

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[1] A diatomaceous silica obtained from Johns-Manville.

A Simplified Method for the Determination of Chromic Oxide (Cr_2O_3) when Used as an Index Substance[1]

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Schürch *et al.* (*1*) have pointed out the advantages of using chromic oxide as an index substance for the determination of digestion coefficients. They have described a colorimetric method using sodium peroxide fusion for the determination of chromic oxide. One disadvantage of this method is that when the final solution is determined colorimetrically it does not follow the Beer-Lambert law.

Carroll and co-workers (*2*) have used the chromic oxide technique for the determination of the site of the nitrogen absorption in rats. With a rapid, simple, accurate method for the determination of chromic oxide (Cr_2O_3) its usefulness as a reference substance can be extended.

[1] Published with permission of the director of the North Dakota Agricultural Experiment Station.

During the past several years, perchloric-sulfuric acid digestion with molybdenum as a catalyst has been used for the determination of phosphorus (*3, 4*). This method has been successfully applied to the determination of chromic oxide.

Preparation of oxidizing reagent: Dissolve 10 g sodium molybdate in 150 ml distilled water. Add slowly 150 ml concentrated sulfuric acid. Cool. Add 200 ml perchloric acid (70–72%) and mix thoroughly.

Analytical procedure: Transfer 100–500 mg sample containing 1–5% Cr_2O_3 which has been ground through a 40-mesh sieve to a dry 100-ml Kjeldahl flask, calibrated to 110 or 100 ml. Add 5 ml of the oxidizing reagent in such a manner that it will wash any adhering particles down the side of the flask. Heat flask over microburner which has had the holes in the asbestos board enlarged so as to allow more heat to come in contact with the flask. Oxidation will begin in 1 or 2 min. Allow the sample to digest until a clear digestion mixture is obtained. In the oxidation of some samples, black particles adhere to the neck and sides of the flask. In these cases turn flask 180°, allowing the samples to digest 2 or 3 min longer. Turn off the burner and add 2 ml perchloric acid (70–72%) to the digestion mixture and then reheat. Cool slightly and add 50 ml distilled water. Cool to room temperature and make up to volume in the calibrated Kjeldahl flask, and let flask stand a few minutes to allow silica to settle. Transfer solution gently from the Kjeldahl flask to a colorimetric tube, and read (440 μ filter) against distilled water set at 100.

Prepare a standard curve by oxidizing a known amount of chromic oxide (Cr_2O_3) which is to be used as a reference substance. Dilute contents to a definite volume with distilled water. Take different aliquots of this solution and dilute with distilled water to give different concentrations of chromic oxide within 10–120 μg/ml when the Evelyn Photoelectric Colorimeter is used.

Different amounts of chromic acid were oxidized and made up to a definite volume and read in an Evelyn Photoelectric Colorimeter. It was found that the Beer-Lambert law was applicable when the transmission was more than 30%. This was also true when the oxidized Cr_2O_3 solution was diluted to different known concentrations with distilled water.

The method was tested further by oxidizing different-sized samples of feces or feeds containing chromic oxide (Cr_2O_3). The equivalent feces or feed contents were plotted against the galvanometer reading on a semilogarithmic 1-cycle graph paper. A straight line was obtained.

This method is rapid, simple to manipulate, and accurate. A set of six samples can be oxidized within 10 min.

It might be added here that several thousand samples have been oxidized in this manner under the direction of the senior author for the determination of phosphorus. No explosions have resulted. One precaution is adhered to, and that is never to oxidize more than a 500 mg sample.

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Glyceraldehyde Phosphate Dehydrogenase of Green Plants [1,2]

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The operation of the glycolytic cycle in the metabolism of green plants has received strong experimental support from the findings of Benson and Calvin (*1*) that known intermediates of glycolysis are the principal products of short-time photosynthesis. In very short periods of photosynthesis, of the order of several seconds, most of the newly fixed $C^{14}O_2$ wns found in the carboxyl of phosphoglyceric acid (*1, 2*). With increasing exposure to light, the proportion of total radioactivity fixed in the phosphoglycerate decreased, and newly fixed carbon dioxide was detected in a relatively large array of compounds, including triosephosphate, hexose diphosphate, and sucrose (*1*).

$$\text{Glyceraldehyde-3-phosphate} + H_2PO_4^- + DPN^+ \rightleftharpoons \text{3-phosphoglycerate} + DPNH + H^+. \quad (1)$$

The identification of phosphoglycerate as the main early product of photosynthesis pointed to the special importance in green plants of glyceraldehyde phosphate dehydrogenase, the enzyme catalyzing the reversible reduction of phosphoglycerate to triosephosphate according to Eq. (1).[3]

Without this enzyme, the path from phosphoglycerate to carbohydrate synthesis would be blocked. However, the occurrence of glyceraldehyde phosphate dehydrogenase in green plants was recently called in question. Tewfik and Stumpf (*3*), studying the degradation of fructose diphosphate, found that this enzyme, although present in the seed, disappeared from the leaves of pea plants, and Stepka (*4*) concluded from inhibition studies of *Chlorella* with iodoacetamide that reaction 1 is not involved in sugar formation in photosynthesis.

The distribution of glyceraldehyde phosphate dehydrogenase in mature green leaves of sugar beets, spinach, sunflower, and tobacco was studied in our laboratory. Plants were grown in synthetic nutrient solutions in a greenhouse until mature leaves were formed. Immediately following the harvest, the leaves were washed in glass-distilled water and stored in a turgid condition in the cold (5° C). The midribs were removed and 60 g of leaf blades prefrozen at −35° C were blended for 30 sec with 150 ml 0.1 *M* K_2HPO_4. To the blend was added slowly, with stirring, 450 ml cold acetone (−35° C), and the slurry was filtered with suction. The filtrate was discarded, and the residue (acetone powder) was rinsed several times with cold acetone, sucked dry until the odor of acetone could no longer be detected, and dried *in vacuo* over P_2O_5. The dry acetone powder was stored at −35° C; 0.5 g acetone powder was extracted with 10 ml cold water for 10 min, centrifuged, and the residue discarded. The supernatant fluid was filtered, and the clear filtrate, designated acetone powder extract, was used as a source of the glycolytic enzymes. Similar acetone powder extracts were prepared, using either 0.05 *M* phosphate or 0.2 *M* tris (hydroxymethyl) amino methane buffer at pH 7.3. The activity of glyceraldehyde phosphate dehydrogenase was measured by a slight modification of the optical test of Warburg and Christian (*5*) in a Beckman Model DU spectrophotometer. This test is based on the increase in optical density at 340 mμ of the reaction mixture, as a result of the reduction of the pyridine nucleotide, when the reaction proceeds from left to right in accordance with Eq. (1).

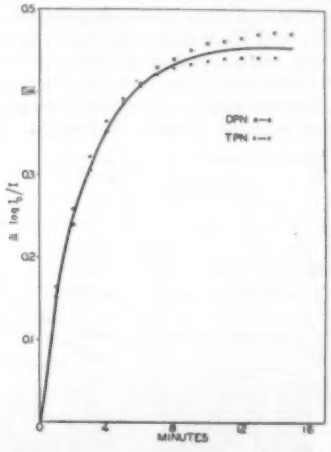

FIG. 1. Oxidation of glyceraldehyde-3-phosphate by crude leaf glyceraldehyde phosphate dehydrogenase. The reaction mixtures contained each 0.3 mg of a dioxane compound of DL-glyceraldehyde-1-bromide-3 phosphoric acid, 0.3 ml of the enzyme preparation and the following in μm: DPN, 0.214 *or* TPN, 0.218; sodium arsenate, 15; sodium fluoride, 10; tris (hydroxymethyl) amino methane buffer pH 8.2, 100; and water to 3.0 ml final volume. The reaction was started by adding the glyceraldehyde phosphate. Quartz cuvettes, $d = 10$ mm.

The acetone powder extract was found to contain aldolase, isomerase, and glyceraldehyde phosphate dehyrogenase (*6*). Glyceraldehyde phosphate dehydro-

[1] Aided by a grant from the U. S. Public Health Service.

[2] After this paper was submitted for publication, M. Gibbs reported independent observations on glyceraldehyde phosphate dehydrogenase in green plants (*Nature*, **170**, 164, [1952]).

[3] The following abbreviations will be used: DPN^+—oxidized diphosphopyridine nucleotide (coenzyme I); DPNH—reduced diphosphopyridine nucleotide; TPN^+—oxidized triphosphopyridine nucleotide (coenzyme II); TPNH—reduced triphosphopyridine nucleotide.

genase from yeast (*5*) and from rabbit muscle (*7*) is DPN-specific. It was found, however, that the acetone powder extract oxidized glyceraldehyde-3-phosphate with either DPN or TPN. The identity of the reduced DPN and TPN at the completion of the reaction was established by their reoxidation with acetaldehyde and oxidized glutathione, respectively (*6*), thus ruling out a possible interconversion of the two pyridine nucleotides. The acetone powder extract contained alcohol dehydrogenase, which is specific for DPN, and glutathione reductase (*8, 9*), which is specific for TPN. It appears, therefore, that unlike the reaction in yeast and muscle, glycolysis in the leaf can proceed with either TPN or DPN. The reversible oxidation of 3-phosphoglyceraldehyde in leaves can thus be also represented by Eq. (2).

$$\text{Glyceraldehyde-3-phosphate} + H_2PO_4^- + TPN^+ \rightleftharpoons \text{1,3-phosphoglycerate} + TPNH + H^+. \quad (2)$$

The oxidation of glyceraldehyde-3-phosphate[4] with either DPN or TPN is shown in Fig. 1. In these experiments the acetone powder extract was treated (*5*) to remove aldolase and isomerase. The resulting partly purified glyceraldehyde phosphate dehydrogenase preparation oxidized fructose diphosphate (Fig. 2)

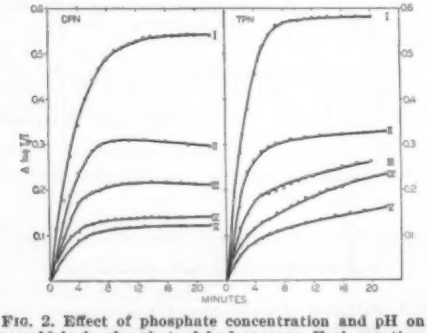

FIG. 2. Effect of phosphate concentration and pH on leaf glyceraldehyde phosphate dehydrogenase. Each reaction mixture contained 0.24 ml of the enzyme preparation, 0.1 ml of a crystalline aldolase solution, and the following in μm: DPN, 0.26 *or* TPN, 0.28; sodium fluoride, 10; fructose diphosphate, 3; and tris (hydroxymethyl) amino methane buffer, 100; water to a final volume of 3 ml. I—pH 8.5, 15 μm sodium arsenate, II—pH 8.5, 90 μm potassium phosphate, III—pH 8.5, 30 μm phosphate, IV—pH 8.5, 3 μm phosphate, V—pH 7.3, 90 μm phosphate. Reaction was started by adding the fructose diphosphate. Quartz cuvettes, $d = 1.0$ cm.

only upon addition of aldolase. Crystalline aldolase was prepared (*10*) by R. H. Hageman and recrystallized once.

The enzymatic tests described so far were carried out under nonphysiologic conditions in the presence of arsenate. The question arises as to which of the two coenzymes, DPN or TPN, is responsible for the reduction of phosphoglyceric acid and the oxidation of phosphoglyceraldehyde in the green cell. Are there two enzymes in the leaf, one DPN- and one TPN-dependent, or is there one enzyme which is capable of using either DPN or TPN? A full answer to these questions must await further purification of the enzyme. This work is now in progress. The following observations which can be cited at this time appear relevant, however.

The reversibility of reactions 1 and 2 was studied by a method analogous to that used by Warburg and Christian (*5*) for the study of the reversibility of the crystalline yeast glyceraldehyde phosphate dehydrogenase. The oxidation of glyceraldehyde-3-phosphate was measured at different pH values and at different concentrations of phosphate. The results are presented in Fig. 2. Curve I for DPN and TPN represents the arsenate systems in which the oxidation of glyceraldehyde-3-phosphate proceeded irreversibly until all the pyridine nucleotide present was reduced. Curves II, III, IV, and V in the DPN series show characteristic equilibrium reactions, which, in accordance with Eq. (1), are dependent on the concentration of inorganic phosphate and hydrogen ion. In the TPN series, however, only Curve II, with the highest phosphate concentration at pH 8.5, shows an approach to equilibrium. At pH 7.3 with this phosphate concentration equilibrium has not been attained in the same period of time (Curve V). This was also the case at pH 8.5 with the lower phosphate concentrations (Curves III and IV).

Whatley (*11*) and Anderson (*12*) found that TPN, rather than DPN, was the dominant pyridine nucleotide in green leaves. It is possible, but by no means certain until the enzyme is purified, that the glyceraldehyde phosphate dehydrogenase of green leaves is normally a TPN-dependent enzyme which can also act through DPN. If there is only one glyceraldehyde phosphate dehydrogenase in leaves, its properties are different from those of the yeast (*5*) and muscle (*7*) enzymes. Warburg and Christian (*5*) concluded that the yeast enzyme does not combine with TPN; the crude leaf enzyme can act with either DPN or TPN, and under physiologic conditions its activity through TPN is greater. Cystein, which was found essential for the DPN reduction by the crystalline enzyme from either muscle or yeast (*7*), was not required for the reduction of either DPN or TPN by the crude leaf enzyme. In certain preparations, however, a marked activating effect of cystein was observed, especially on the DPN reduction. The leaf glyceraldehyde phosphate dehydrogenase is strongly inhibited by iodoacetamide, but the TPN reduction is more resistant to the action of the inhibitor (*6*). The last observation may also perhaps account in part for the previously cited results of Stepka (*4*).

The leaf glyceraldehyde phosphate dehydrogenase was found to be localized in the cytoplasmic fluid, rather than in the chloroplast. This finding provides additional support for the view (*13*) that photosynthesis involves an interaction between the particles of chloroplasts, in which the initial photochemical events take place, and the soluble enzymes of the surrounding cytoplasmic fluid.

[4] Kindly given us by E. Baer, through the courtesy of H. O. L. Fischer.

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Formation of Large Bodies in a Member of the Genus *Bacillus*

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Cultures of a spore-forming *Bacillus* of the brevis-polymyxa group were examined on thin blocks of serum agar. A Bausch & Lomb phase contrast microscope attachment was used on a Leitz "Panphot" microscope with a 97× objective and a 15× ocular. Time-sequence pictures were taken with Kodak Microfile film. "Large bodies" (of the Dienes and Klieneberger-Nobel type) were often found in great numbers in cultures that had completed logarithmic growth. Such large body formation continued for one or two days afterward. Fig. 1 shows pictures of the same

FIG. 1. Formation of two large bodies from a single rod.

cell taken at the indicated time intervals. It demonstrates the direct transformation of a rod into two separate large bodies, one of them rodlike in shape and the other ovoid. Both elements show clearing of the cellular material and abundant granules. These granules were highly motile, and their movement appeared to follow a definite pattern, like a chain that is pulled from one end. This movement was observed for periods of time up to 48 hr, after which it gradually ceased. The granules were also found outside the cells, swimming freely on the agar, singly or in chains. Their fate could not be determined by direct observations. In Fig. 2, the cell labeled *1* shows a central swelling that is followed by swelling of the rest of the cell, with the formation of a round, ovoid-shaped large body. Cell 2 also has undergone a change into an element that is similar to, but smaller than, the preceding. Cell 3 developed into a rod-shaped element of similar structure. In Fig. 3, the culture was transferred from a 24-hr culture that showed an abundance of large bodies. Over a period of 30 min the cell undergoes a clearing and shows granules; granules are also seen outside and adjacent to the cell.

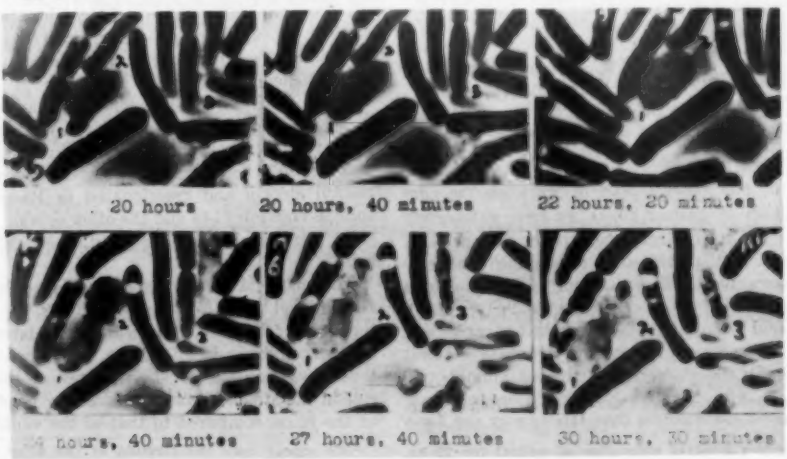

FIG. 2. Formation of balloonlike large bodies from rods (*1* and *2*) and of rodlike elements (*3*).

The formation of large bodies was observed to occur

[1] The author wishes to thank David Paretsky for helpful advice and encouragement.

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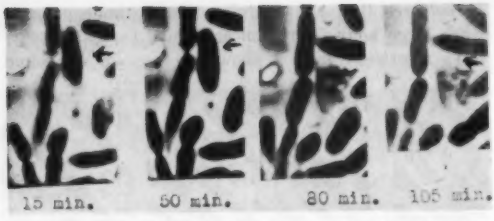

FIG. 3. Transfer from a 24-hr culture. Formation of a large body and extracellular granules.

in this fashion in a great number of cultures. No evidence of fusion was found, as described for *Proteus* (*1*). The development of these elements was not determined, since they remained unaltered for periods up to 3 weeks, except for budding in a few instances. No cell-wall stains were made to determine whether fusion between different cells of the same rod took place. It appears that in this organism the formation of large bodies follows a pattern of direct transformation from rods to either balloon-shaped or rodlike structures. They are more like the ones described for *Azotobacter agile* (*2*) than for other gram-negative bacilli. No evidence of the events described by Klieneberger-Nobel (*3*) was found here.

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Prevention of Ulcers in the Shay Rat by Ox Bile[1]

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As part of our general plan of work on the cure and prevention of gastric ulcers we have extensively studied (*1*) the preventive action of certain salts of organic acids on the formation of stomach and esophageal ulcers in the Shay (*2*) rat.[2] We came to a clear-cut conclusion that certain salts, particularly potassium acid acetate, display a marked curative and preventive action when given per os, in a dose of about 75 mg. Usually the stomachs of treated animals are coated with a mucuslike lining, and the action is independent of the alkalinity of the salts, excellent results being obtained with material given at pH 4.5.

In our second communication (*3*) we studied the role of hematuria and pigmented urines in the causation of ulcers. The relationship of the two phenomena, and the finding that practically no ulcers were observed in animals having hematuria or pigmented urine, suggested a possible role of bile in ulcer prevention. Madden, Ramsburg, and Hundley (*4*) reported that ligation of the esophagus, ureters, or the bile duct resulted in gastric ulcer prevention. Our inquiries among several internists as to whether icterus is associated with ulcer remissions yielded no answer.

Our experiments with bile were started with fresh ox bile and later continued with a USP bile powder preparation and with some isolated fractions and purified bile acids obtained from fresh bile. The experimental methods and the formulation of the "ulcer index" in this study were identical with those of our previous communications.[3]

The bile fractions from fresh bile were prepared as follows. Bile, normally alkaline, was neutralized to pH 7.0 with dilute sulfuric acid, and evaporated *in vacuo* to dryness. The residue was dissolved in alcohol, and a small amount of insoluble material (mostly mineral) was filtered off. Benzene was added to the filtrate. After it was allowed to stand at −10° C overnight, an insoluble material (Bile-3) was filtered off. The filtrate (Bile-4) was evaporated and dried *in vacuo*. Bile-4 was extracted with ethyl acetate, and the soluble fraction precipitated with ether (Bile-11). Concentrated sulfuric acid was added to the ether soluble. A precipitate formed (Bile-12), which was separated off by centrifugation. In view of the possible preventive action of some mineral organic acid combinations, the ash content of our fractions was estimated and found to be below 8%, a quantity entirely insufficient to exert any beneficial effect.

The commercial bile powder was exhausted in a large Soxhlet, allowing a cold extraction with ethyl acetate. The extract, sterol material (13) free from bile acids was tested, the extracted powder was dissolved in methyl alcohol and fractionated as Ba-salts, one insoluble fraction (14) and the other soluble (15). These salts were decomposed quantitatively with sulfuric acid.

The material to be tested was given by mouth in two divided doses totaling 50–150 mg, the first one at the time of ligation, the second 3 hr later. The total dose was given in ⅛ ml volume, the amount of wastage thus being minimized. The presence of the bile material in the stomach was evidenced by heavy milkiness of the juice, compared to that of the controls.

[1] Work supported by a grant from the U. S. Vitamin Corp. and by numerous contributions from this country and Latin America.

[2] The procedure involves starvation of animal for 72 hr, then ligation of pylorus under ether anesthesia. The abdominal wall is clipped and coated with collodion to prevent licking of blood. Animals are sacrificed 8 hr after ligation and stomachs removed. Stomach contents are collected, and the washed stomach is stretched upon a white surface for examination. Some animals die from perforated ulcers before 8 hr.

[3] We repeat here the formula of the ulcer index: Each ulcer animal is graded from 0 to 4, according to the extent of ulcerations, perforations, and time of survival, 4 being maximum ulceration. The individual ratings for each group of animals are added, multiplied by 100, and divided by the number of rats in the group, so that: $\frac{\text{Ulcer} \times 100}{\text{No. of rats}} = \text{ulcer index}$. Maximum, therefore, is 400.

TABLE 1

Fraction	Dose	pH of solution	Ulcer index T*	(C†)	pH of stomach juice T	(C)	No. animals T	(C)
1 Ox bile 1:4	1/8 ml	Above 7	100	(333)	7.0	(3.1)	3	(3)
2 Chloroform ext of 1	1/8 "	Below 7	129	(200)	2.1	(1.8)	7	(6)
3 Water ext of 1	1/8 "	" 7	129	(200)	2.2	(1.8)	7	(6)
4 Alcohol ext of 1	1/8 "	" 7	192	(227)	2.7	(2.3)	12	(11)
5 Bile-2	33 mg	" 7	158	(300)	2.7	(1.7)	12	(8)
6 Bile-3	75 "	" 7	50	(289)	2.5	(1.4)	6	(6)
7 Bile-3	150 "	" 7	30	(242)	3.3	(1.3)	10	(12)
8 Bile-4	100 "	" 7	118	(233)	2.8	(1.6)	11	(7)
9 Bile-3 + Bile-4	50 + 50 "	" 7	56	(243)	3.2	(2.0)	9	(7)
10 Bile-11	100 "	" 7	125	(338)	2.8	(2.5)	8	(8)
11 Bile 12	50 "	" 7	243	(338)	1.9	(2.5)	7	(8)
12 Bile-13	50 "	" 7	264	(217)	2.2	(1.7)	11	(12)
13 Bile-14	100 "	*ca* 5	138	(300)	3.1	(1.6)	8	(8)
14 Bile-15	100 "	" 6	57	(300)	4.0	(1.6)	7	(8)
15 Ox bile powder (Eimer & Amend)	150 "	Above 7	64	(291)	2.8	(1.7)	11	(11)
16 Cholic acid (Matheson)	150 "	" 7 (NH_3 salt)	160	(200)	2.9	(2.2)	10	(10)
17 Desoxycholic (Hygrade)	75 "	Below 7	188	(338)	2.2	(1.7)	8	(8)
18 Taurocholic (Eimer & Amend)	150 "	*ca* 7 (Na salt)	200	(338)	2.9	(1.7)	8	(8)
19 Dehydrocholic (Hygrade)	150 "	Below 7	238	(213)	2.5	(1.5)	8	(8)
20 Glychocholic (digestive ferments)	150 "	*ca* 7 (Na salt)	100	(213)	3.0	(1.5)	3	(8)
21 Lithocholic (Winthrop-Stearns)	150 "	Below 7	150	(263)	1.9	(1.6)	8	(8)
22 Mixture of above acids	25 " each	Neutral	238	(263)	1.8	(1.6)	8	(8)

* T = Treated animals.
† C = Controls.

The therapeutic results with the fractions are summarized in Table 1.

From Table 1 we can conclude that fresh bile, commercial bile powder, and fractions made from the above possess a distinct preventive action against Shay rat ulcers. Some of the isolated bile acids show less effect, on the whole, than the more complicated fractions, but a mixture of known bile acids proved inferior to the same total dose of any one acid. We have routinely titrated to standard end points the stomach juices of our animals. A typical analysis of the stomach contents is given in Table 2.

Since both total and combined acid are so much lower in the treated group, it would seem that the action of the bile compound is to reduce secretion of acid rather than to neutralize acid that is normally secreted. In Funk *et al.* (*1*) and in the present paper we have found marked anti-ulcer and anti-acid secretion activity of substances which themselves were distinctly acid or at least neutral.

The question remains as to whether bile contains a small amount of active substance which contaminates the bile acids and the fractions obtained from bile, or whether it is a bile acid itself which is active. The investigation is being continued, but it can be said now that the described activity is not in any way bound to the alkaline reaction of the products tested.

TABLE 2

Substance	Total acid	Free acid	HCl	Combined acid
Bile-3	39.2 mEq/l	27.9 mEq/l	15.2 mEq/l	11.2 mEq/l
Control	70.1 "	59.7 "	50.8 "	10.5 "

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Comments and Communications

You Just Pays Your Money

WALTER ROSE (SCIENCE, 116, 70 [1952]) says "it does not seem to be a serious matter how soon the social science law of energy conservation is discovered, as long as thinkers can be delighted and excited by thoughts of social science perpetual motion machines." Such a social science law of energy conservation was discovered long ago, however—just how long ago I do not know. It reads: *"Plus ça change, plus c'est la même chose."*

And still thinkers all the way from philosophers to politicians continue to devise Utopias.

Mr. Brown in his rejoinder seems to suggest that he thinks "the natural course of development is toward dissolution and decay." That, I suppose, would be the social law of entropy, which has for the time being become a part of the law of conservation of energy. "Change and decay in all around I see" is not a new idea, but it is not the same as the social science law of the conservation of energy. Nor is it the same as Utopianism.

One of the profound contributions of classical economic theory to modern thinking is its three laws of returns. There is a law of diminishing returns, a law of constant returns, and a law of increasing returns. I suppose the privilege was granted of electing any one of these three jurisdictions, all of which has disadvantages as well as advantages. Evidently some such all-embracing trio is going to be necessary to suit everybody in the social sciences—one for the pessimists, one for the cynics, and one for the optimists. As the operator of the three-shell game used to say, "You pays your money and you takes your choice."

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Digesting Tissue Samples

THE article on "The Preparation of Wet Ashed Tissues for Liquid Counting" (SCIENCE, 115, 597 [1952]) exemplifies the fact that most biologists and biochemists are not acquainted with a satisfactory method that has been in routine use in the laboratories of the Atomic Energy Project of the University of Rochester during the past eight years for complete digestion of tissues and all other biological matter.

It might be of value to your readers to call their attention to this method. It is given in detail on pp. 15–18 of Vol. VI-3 of the "National Nuclear Energy Series," *Biological Studies with Polonium, Radium and Plutonium* (New York: McGraw-Hill [1950]).

The digestion procedure is simple and rapid, and results in complete aqueous solution of all tissues. Over 10,000 samples have been digested by this method with very satisfactory results. The author wishes to stress that the proportions and details given in the reference must be followed. Departures from the method may cause rapid reaction, with resultant losses from boiling over or burning; attention to several factors pointed out therein will obviate these occurrences.

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WE ARE glad Dr. Minto has called attention to the method that has given such excellent results in the hands of workers at the University of Rochester. We were aware, of course, that there are other methods of digesting tissue samples so as to obtain a homogeneous solution, but it seemed that an extensive review of the literature would be out of place in the brief note that we submitted. We have simply reported one method which we have found particularly useful under certain circumstances where the use of perchloric acid was considered inadvisable.

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Saucers?

IN VIEW of the interest in so-called flying saucers, and the lack of an adequate explanation for them, perhaps it would be well to call attention to earlier references to such phenomena.

The first reference concerns unusual forms of lightning and is as follows: "Lightning: Its Risks and How to Avoid Them," by Elihu Thomson, C. A. Adams, Louis Bell, D. C. Jackson, and A. E. Kennelly (*Gen. Elec. Rev.* [Mar. 1916]). On page 167 are the following paragraphs:

> (5) Ball or Globular Lightning—There are numerous records to the effect that a very rare and perhaps dangerous form exists, described by some observers as a luminous but not very brilliant ball or patch, which may persist for some little time and may move from place to place. It is described as terminating, in many cases, in a loud explosion. No doubt many cases of reported ball lightning are fictitious or illusory. Owing to the great rarity of ball lightning, practically nothing is known of its nature or of the dangers, if any, accompanying it.
>
> (6) Bead Lightning is another very rare form of discharge described as resembling a chain of beads gradually fading away. Nothing seems to be known of the danger, if any, connected with it.

The second reference is contained in a letter by the late John Zeleny published in SCIENCE, January 15, 1932, entitled "Rumbling Clouds and Luminous Clouds." In this letter Mr. Zeleny describes two rather unusual clouds, both of which he was fortunate enough to observe. One of these he saw in July 1931 over Cache Lake in Ontario on a chilly cloudy morning. This cloud he described as passing over the lake in the form of "a very long, narrow, tenuous cloud—whose cross-sectional diameter was only 200 feet." This cloud moved at right angles to its length and gave off a very loud rumbling sound. The other cloud

he described as having seen on a clear summer night at Hutchinson, Minn. This he describes as "a solitary, brightly, luminous, cumulus cloud," which "shone with a uniform, steady, vivid, whitish light." He also adds: "I have been at some loss to account for the luminosity of the cloud. It could not have been due to reflected light coming from a city."

Could not the objects in the sky (the saucers) and the objects seen by Mr. Zeleny be one and the same thing? Could not these objects be moved by wind currents and perhaps, too, be magnetic fields? Could they not be tied in with the phenomena of ball lightning, occurring very rarely under conditions favorable to thunderstorm activity?

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The Use of Hydrofluoric Acid in Making Glass Microneedles[1]

THE following procedure provides a simple solution to the problem of making glass microdissection needles, such as those used in isolating yeast ascospores. The technique obviates the need for an expensive microforge (*1, 2*) by utilizing a 50% solution of hydrofluoric acid to produce a smooth, sharply pointed microneedle. Stepwise etching with acid provides control over formation of the point, whereas control is difficult to obtain with manual or mechanical pulling techniques.

Six-inch lengths of 2 or 3 mm soft glass rod provide the stock from which needles are made. One end of the rod is reduced in diameter to about 30 μ over a length of about 1 in. The small end of this filament is grasped firmly but gently with flat forceps. While a steady pull is exerted, this portion of the needle is moved slowly toward the flame of a microburner[2] until it heats rapidly and is pulled out into a hairlike *pointed* filament. The length and character of this portion of the needle are unimportant, provided only that the needle *tapers* to a point rather than ending in a fused bead.

All necessary bends are introduced before the point is etched, so as to avoid accidental heating and destruction of the delicate tip. Bending is best accomplished by bringing the needle near, but not into, the microburner flame *from the side* and guiding it with a metal dissecting needle as the glass softens. The exact bends required will depend on the type and dimensions of the moist-chamber type of micromanipulator clamp, and other apparatus used.

For the etching process, aqueous solutions of HF (50%) and sodium bicarbonate (saturated) are used. These solutions and two rinses of distilled water are placed in beakers large enough to minimize accidental contact with the walls during agitation of the needle in the solutions. The etching is carried out by immersing about 1 in. of the pointed end of the needle in HF for 5–20 sec, rinsing carefully and thoroughly, first in the bicarbonate solution, then twice in distilled water. Progress of the etching is followed under low power of a compound microscope. Etching is repeated until any hairlike tip is dissolved and the fine point of the needle is brought into the desired relationship to the heavier shank.

It should be emphasized that the HF must be neutralized completely by thorough rinsing in bicarbonate, otherwise pits and roughened areas will develop along the shank. These tend to retain HF from subsequent etchings and may in time result in weakening and breakage of the microneedle.

To a great extent this etching technique removes the uncertainty inherent in manual and mechanical needle-making procedures. Uniformly reproducible tools may be made with a minimum of previous experience. Stepwise etching with HF has been used successfully to produce flexible spatulate needles (*3*), and other applications are doubtless possible.

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[1] Abstracted from a dissertation submitted to the Graduate School of Yale University in partial fulfillment of the requirements for the Ph.D. degree.

[2] A serviceable microburner may be made from a 22-gauge hypodermic needle with the bevel removed.

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Book Reviews

The Theory of Relativity. C. Møller. New York: Oxford Univ. Press, 1952. 386 pp. Illus. $7.00.

This new addition to the "International Series of Monographs on Physics" is in many respects a remarkable one, which no teacher of relativity theory can afford to overlook. It contains many novel ideas, even for people familiar with relativity theory, and it will help answer students' questions that are not answered in other texts. Many references to original literature have been given in footnotes, but much of the material has never been published before.

About half the book deals with special relativity

theory, beginning with a historical survey of the developments that made Einstein's hypothesis appear as a simplification of physics. After a thorough discussion of special relativistic kinematics, including the Thomas precession, there follows a chapter on special relativistic mechanics, in which Møller's proofs of the equivalence of energy and mass are unusually clear.

An introduction to tensor algebra is followed by discussions of successive infinitesimal Lorentz transformations, the motion of incoherent matter and its kinetic energy-momentum tensor, electrodynamics in vacuum, mechanics of general closed systems, definition of center of mass, mechanics of elastic continua and of perfect fluids, and a note on meson theory. Discussions of nonclosed systems, electrodynamics in matter, and special relativistic thermodynamics follow.

The second half of the book is devoted to general relativity. After an explanation of the principle of equivalence, Møller clarifies the transition from the special to the general theory by including an extensive discussion of rotating and of nonrotating accelerated rigid frames of reference. The discussion of the rotating disk gives a welcome example of a gravitational field that is "stationary" but not "static." The existence of Coriolis forces is a consequence of this fact. It also necessitates a distinction between a 3-dimensional metric tensor describing the non-Euclidean properties of the 3-dimensional space of physical observation, and the spacelike part of the more familiar 4-dimensional metric tensor. It is one of the merits of this text that the $(3+1)$-dimensional physical interpretation of the 4-dimensional fundamental equations of relativity is extensively discussed throughout the book. Thus, in the general theory, attention is not confined to finding "world lines" describing the motion of a particle in 4-space, but is directed toward finding how such a particle would describe a trajectory in the corresponding non-Euclidean physical 3-space. The 3-component gravitational force acting on such a particle is derived from the dynamic gravitational potentials, which are expressed in terms of the metric for 4-space. The discussion of the velocity-dependent forces—so important as the Coriolis force in the case of a rotating frame of reference—is postponed from this introduction on rotating disks, until Møller has discussed general tensor calculus, local systems of inertia, non-Euclidean differential geometry, and the momentum and mass of a particle in a general gravitational field. Discussions of the combined action of gravitational and other forces, mechanics of continuous systems, and general relativistic electrodynamics and optics in a vacuum follow.

The last two chapters of the book deal with the gravitational field equations and their solution for weak fields, for cases of spherical symmetry, and for a perfect fluid. Also covered are a variational principle for the gravitational equations in empty space, conservation of energy and momentum in gravitational fields, the gravitational mass of a system, the various effects by which general relativity theory can be verified experimentally, and cosmological models. The book closes with nine appendices that are mainly mathematical.

The book is offered as a text not only for students in theoretical but also for those in experimental physics, and the latter are advised to study mainly the first third of the volume. For the benefit of these students, many of the results of the special theory have been derived by using ordinary 3-dimensional vector notation only. This is very instructive, although it does not always simplify the proofs. The author gives explicit formulas in 3-dimensional notation for such fundamentals as the Lorentz transformations for coordinates, particle velocities, phase velocities, and Newtonian forces, as well as for the dragging of light, aberration, etc., for any magnitude and direction of the velocity of the medium or the observer with respect to the light ray. As experimental evidence of special relativity, the transverse Doppler effect is mentioned, as well as Champion's experiments on electron-electron scattering.

In general, Møller's presentation is almost exclusively algebraic, for he has attempted to avoid 4-dimensional geometric interpretation of the formulas of special relativity wherever possible. The reviewer regrets this, because visualization of the theory can help students find, by inspection, solutions of problems of relativity that otherwise require lengthy calculation. On the other hand, the few diagrams in Møller's book that do show a time axis are misleading. The source of this confusion lies in Møller's attempt to keep the special theory simple by treating Lorentz transformations as orthogonal transformations, using $x_4 = ict$. Of course, one cannot correctly draw an imaginary time axis. For correct visualization one must use $x^0 = ct$ as coordinate, which makes it necessary to present Lorentz transformations as oblique transformations in x,ct-space. This slight complication is just what Møller has tried to avoid. The real ct-variable he introduces later, when he comes to general relativity. From here on, x^4 denotes ct. (The notation x^0 is not used.) This and some other unusual or less fortunate notations, not to mention a few printing errors in formulas, should cause no serious trouble to careful readers.

It is a pity that the simple tensor transformations of the special theory were not introduced in the part of the book destined for students of general physics. Instead, the derivation of this equation of motion is given much later, wedged in between discussions of the Wiechert-Liénard potentials and a variational principle. Yet no elementary course in special relativity is complete without this equation, because of its practical importance. (Mentioning it without proof on p. 74 does not help.) Although the book is not entirely adequate for use as a text in a short introductory course in relativity, it is, nevertheless, a most valuable reference, even for beginning students, and still more so for advanced students and for the teacher. Møller's book thus deserves a wide circulation, and it will certainly become one of the recognized standard works

on classical relativity theory. The reviewer considers the book of extreme importance because of its content and originality.

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Food Science: A Symposium on Quality and Preservation of Foods. E. C. Bate-Smith and T. N. Morris, Eds. New York: Cambridge Univ. Press, 1952. 319 pp. Illus. $8.00.

This volume is the outcome of an extended summer course in food science given under the Board of Extra-Mural Studies of Cambridge University in cooperation with the Low Temperature Research Station during 1948. A brief introduction by Franklin Kidd defines food science as the vast field which, beginning with photosynthesis, includes all processes involved in production, composition, storage, and preservation of foods and their utilization, and having fundamental significance for the welfare of mankind.

The editors have skillfully utilized the contributions of 26 British cooperating scientists in this compact and highly informative volume. Seven chapters of varying length supply condensed factual and statistical material of much interest and value. Of these, the first, by N. C. Wright, chief scientific adviser of the Ministry of Foods, presents briefly a concise and valuable summarization of the economics, supply, and distribution of foods in the United Kingdom during the period from 1934 to 1944, and the nutritional status of the population as of 1948.

The second chapter gives an extended survey of the composition, variation, nutritional values, and factors affecting internal changes in the principal foods. Meats, fish, eggs, fresh fruits, and vegetables, and the great group of cereals and milled products are each considered in detail. The book deals primarily with British foods, but its interest is not lessened for the American reader, although certain varieties of fish are unused here, or because some of the procedures described differ in detail from corresponding processes in this country. Chapter 3 discusses competently the basic constituents of foods under the headings proteins, mucopolysaccharides and mucoproteins, carbohydrates, and fats. This valuable chapter is followed by another dealing with "Some Aspects of Quality in Foods," in which the physical and chemical basis of quality, and the significance of the fine structure of biological tissues, both plant and animal, in nature are carefully treated. Chapter 5 deals briefly with "The Microorganisms"—the molds, yeasts, and bacteria—chiefly concerned with the processes of spoilage in foods. The treatment is largely from the physiological standpoint, and the data on the effects of environmental factors on growth are well but possibly too briefly presented. The subject of "Principles of the Control of Microbial Spoilage" especially would seem to warrant more expanded treatment than is given in this section, although the matter is skillfully presented. Chapter 6 devotes 40 pages to an intimate discussion of "Chemical Mechanisms of Spoilage" and covers a wide range of reactions. Rancidity in edible fats and fat-containing foods is treated very fully, its effects on odor, flavor, and appearance being discussed with some detail. The Maillard, or browning, reaction on dehydrated foods is also given careful attention.

The final chapter devotes over 60 pages to the principles of food preservation. Herein are treated the traditional methods of canning, preserving by concentration, refrigeration, and use of chemical preservatives. Much attention is given to refrigeration and quick-freezing and also to dehydration by modern methods; the subject of sugar preserves is likewise given detailed treatment. The recent developments in sterilization by radiation have come since the course was given and therefore are not discussed in detail. This does not impair the value of the chapter as a whole, although the process may have much future interest. An appendix describing "Organization of Research and Information Services in the United Kingdom" completes the volume.

The book is excellently printed, has many illustrations and graphs, and extensive bibliographies at the end of each section. Altogether, it is a book that all food chemists and technologists would find most useful and it should be a valued accession to every library that aims to carry on its shelves the most useful and authoritative volumes dealing with the great subject of food supply and food technology.

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Geometry and the Imagination. D. Hilbert and S. Cohn-Vossen; trans. by P. Nemenyi. New York: Chelsea Pub., 1952. 357 pp. $5.00.

David Hilbert (1862–1943) was a very great mathematician whose research extended into almost every field of mathematics. Furthermore, he was a great teacher and expositor, with a genius for presenting basic ideas uncluttered by details. His insight penetrated far beyond the obvious and brought to light relations previously unobserved. With a self-confidence supported by his pre-eminent position as a mathematician, he did not hesitate to devote attention to mathematics of the most elementary sort, such as arithmetic and plane geometry, and he was able to endow these humble topics with a dignity and depth unsuspected by more superficial observers.

"Intuitive Geometry" would have been a more accurate translation of Hilbert's *Anschauliche Geometrie.* The book, based upon lectures given by Hilbert in Göttingen in 1921, was first published by Springer in Berlin in 1932, and has become a mathematical classic. This translation by Nemenyi is precise and in excellent English. The Chelsea Publishing Company acknowledges indebtedness only to the attorney general of the United States.

There are six self-contained chapters in the book, each devoted to a separate type of geometry. The first chapter mainly concerns the conic sections and quadric surfaces, and until the concluding paragraph coordinates are not used. The purpose is to make the reader

see and feel the proofs, without too much regard for the rules of the game as the Greeks insisted upon playing it. Thus, when Hilbert wishes to construct a sphere tangent to a plane, he merely pushes the sphere up until it touches the plane. In this way he produces a figure from which the reader can see at a glance that a plane section of a right circular cylinder is an ellipse. Further results obtained by this approach are far from trivial.

The second chapter is on lattices and should interest crystallographers. Hilbert gives some exceedingly simple proofs of special cases of theorems from Minkowski's *Geometrie der Zahlen* and a great deal of material that is not to be found in that classic. The regular polyhedra are taken in stride.

Synthetic projective geometry is treated next, with emphasis on configurations. The author can scarcely avoid the use of the word "axiom" in this branch of geometry, but geometrical intuition is placed ahead of formalism. He is thus content to prove Desargues' theorem in the plane by first proving it in space and then projecting the figure onto the plane.

The longest chapter in the book is appropriately given over to differential geometry. That this subject can be developed without coordinates is inconceivable, and in fact we find the author frequently resorting to the it-can-be-proved technique. But for one who has studied the subject in the conventional manner and wishes to clarify his concepts, the exposition is unsurpassed.

Chapter V, entitled "Kinematics," is short. It is devoted to the construction of plane curves by means of linkages and other mechanical devices. The last chapter, on topology, is still a clear introduction to that subject, but a book written 30 years ago cannot be a summary of topology as it is today.

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An Introduction to Physical Anthropology. 2nd ed. M. F. Ashley Montagu. Springfield, Ill.: Thomas, 1951. 555 pp. $8.75.

If a second edition has grown in only six years to nearly twice the size of the first, it goes without saying that it has been thoroughly revised and, besides, must reflect the growth of the science represented. This new edition has matured far beyond its first version, but as an "introduction" it still suffers from one-sidedness—dealing with topics not expected from its title and ignoring others that should form an integral part.

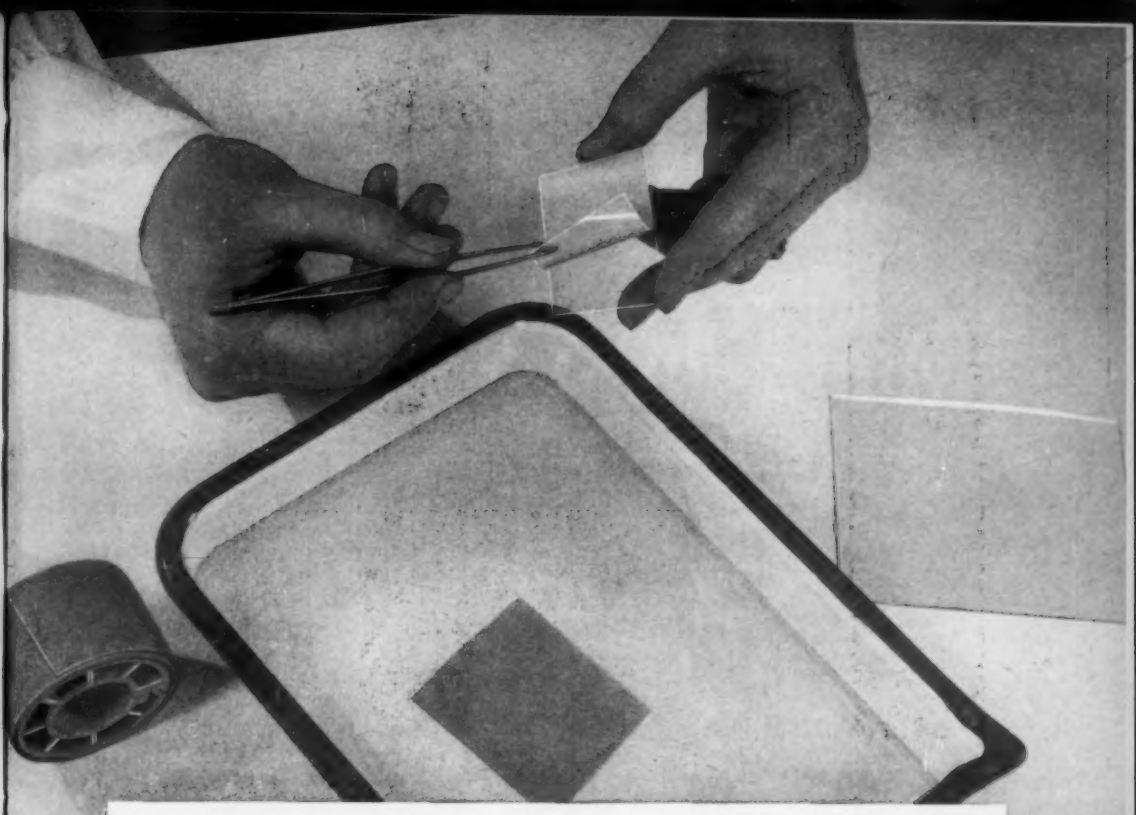
The opening chapter, although accompanied by 11 excellent portraits of men eminent in the history of anthropology, does not provide an account of the historical development of our understanding of man. It defines physical anthropology as "the comparative science of man as a physical organism in relation to his total environment, social as well as physical." The word "social" may be supposed to excuse the later inclusion of a polemic chapter on "the relation between body, mind, and culture," which is clearly out of place. The chapters on primates and their evolution have been greatly improved, particularly through the generous addition of a great many and very good illustrations, but the most important anatomical reasons for man's position among the primates are not made evident. The fourth chapter on the origin and evolution of man provides a fair account of our present incomplete knowledge of this great problem. This vast field of knowledge is growing too rapidly, however, to enable any one man to give a generally acceptable account of it. The pedigree of primates given here in Fig. 105 should have been clearly labeled as "author's interpretation" of phylogenetic relationships, and some justification for these rather partisan views should appear in the text. Besides it should, if at all possible, be explained why this pedigree differs so radically from the one appearing in Fig. 40.

The chapters on "ethnic" differentiation in man are quite readable, partly because some sections were written without regard for documentation and by skipping over problems far from settled. If this volume was designed as an introduction for the layman or first-year student, it should have been considered inadvisable to air controversial matters, for experts will find in these chapters many facile claims in place of a statement of problems they hope to solve in the future. The author's allergy to the legitimate term "race" forms a handicap in these accounts, and his indiscriminate substitution of the terms *division, group, subgroup, type,* and *population* gives the unjustified impression that our species is not subject to race formation, as is the case with all other species.

The final chapter on the effects of heredity and environment upon man is much too short to be called comprehensive, yet it is well written and should induce the lay reader to turn to the selected literature listed in this section, as in all others. The long appendix on anthropological methods has been much elaborated in this new edition but still reveals limitations in at least the metric techniques of the author's science.

Although this *Introduction* is advertised as covering the entire field of physical anthropology, it makes practically no attempt to deal with human age changes, without which the story of the evolution and differentiation of mankind remains incomplete. The book can be recommended chiefly on account of its fluent style, its 161 splendidly reproduced illustrations, and its sectional bibliographies which, although reasonably up to date in regard to English literature, ignore practically all else. This volume represents only a partial and quite personal introduction to the vast science of man, the most interesting part of all biology.

Adolph H. Schultz
Anthropologisches Institut der Universität Zürich



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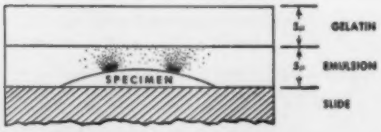

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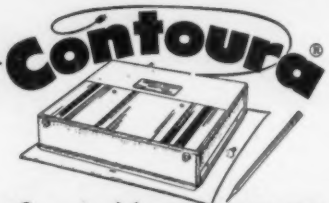

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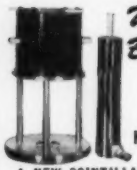

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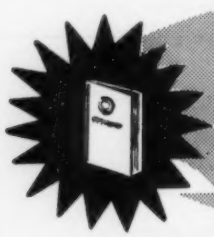

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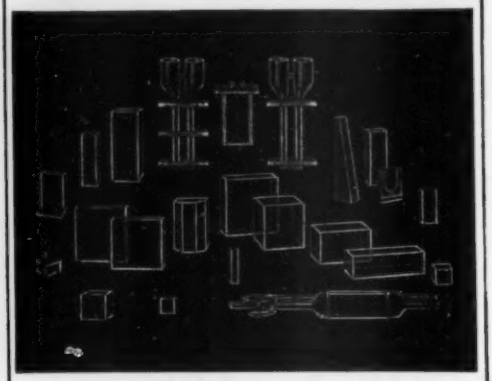

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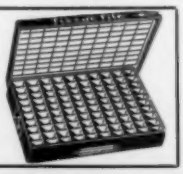

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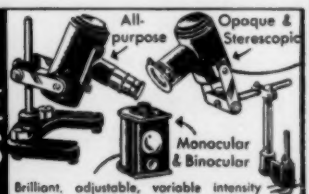

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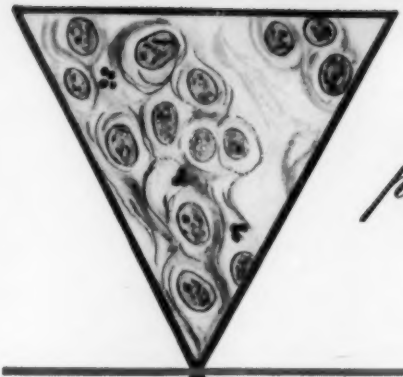

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